THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LX. No. 1527.] LONDON, AUGUST 16, 1892. [44TH YEAR. PRICE 6d.

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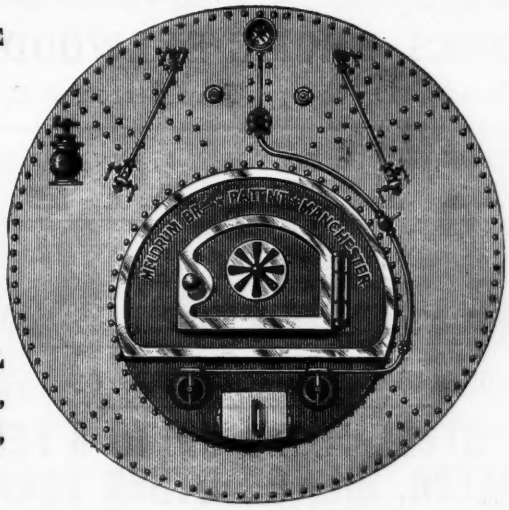

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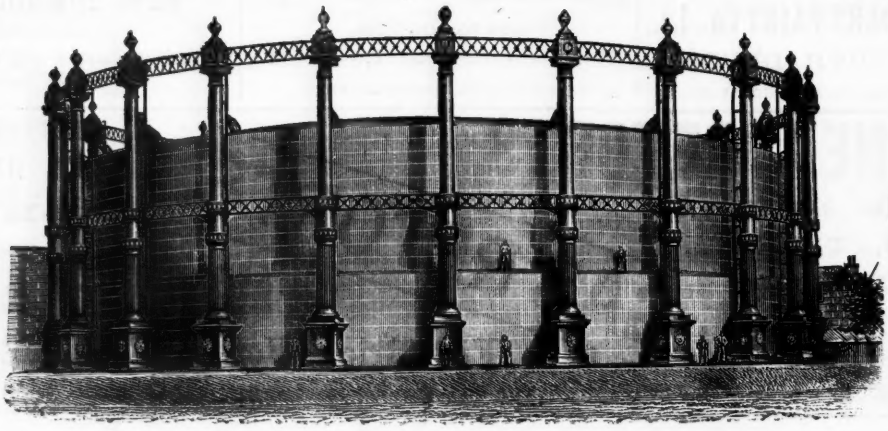

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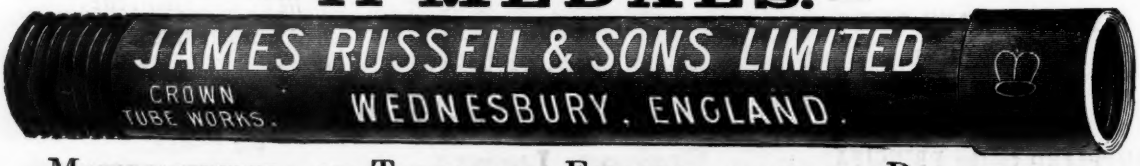

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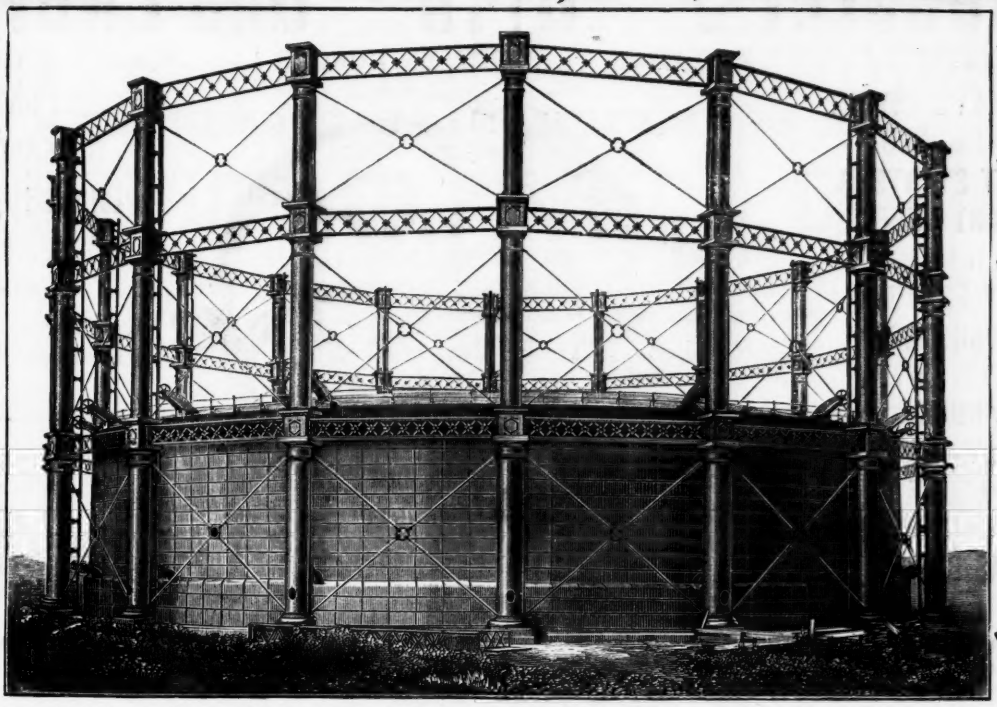

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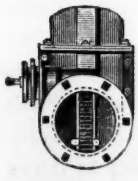

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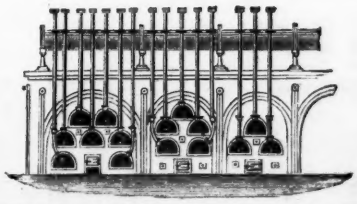

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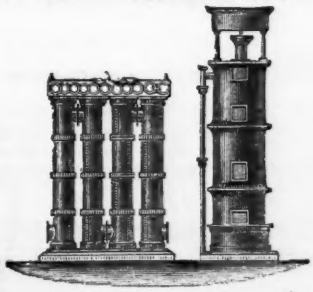

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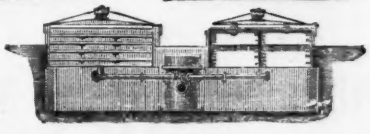

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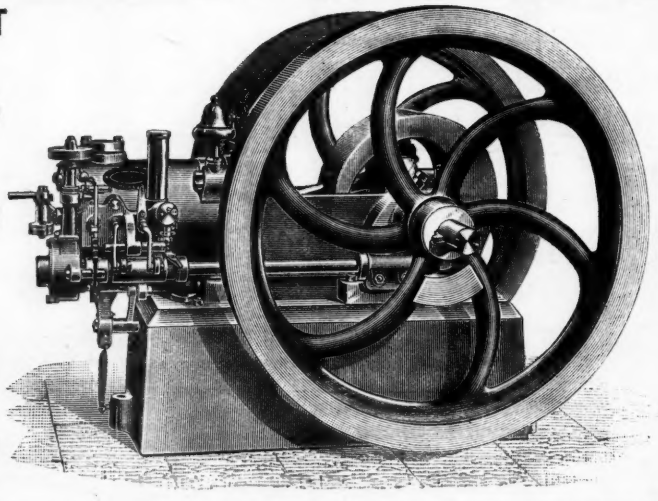

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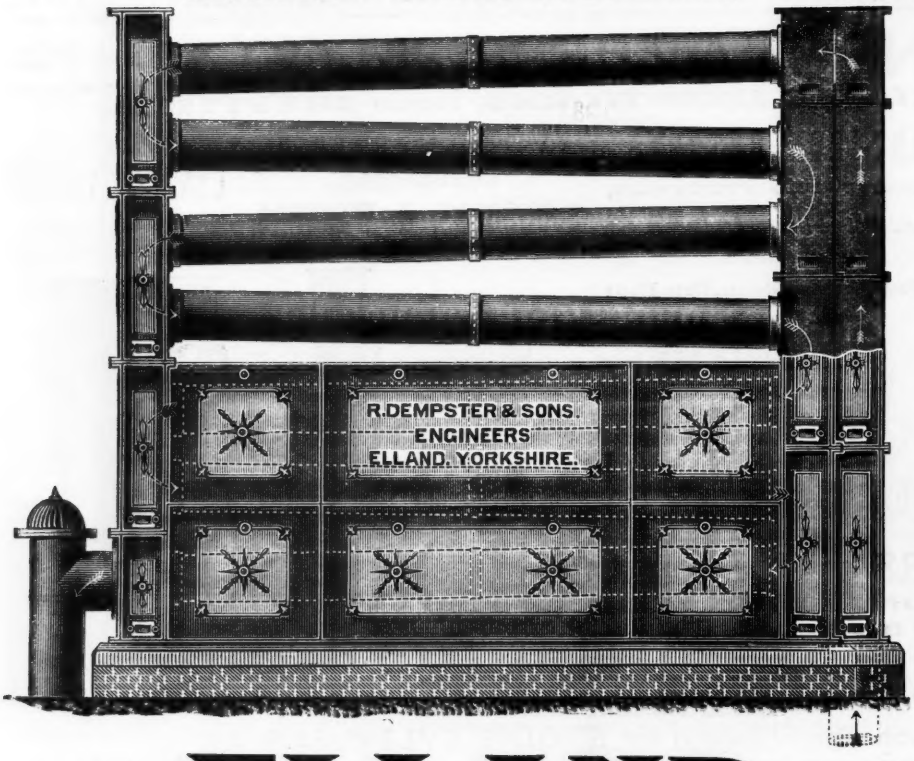

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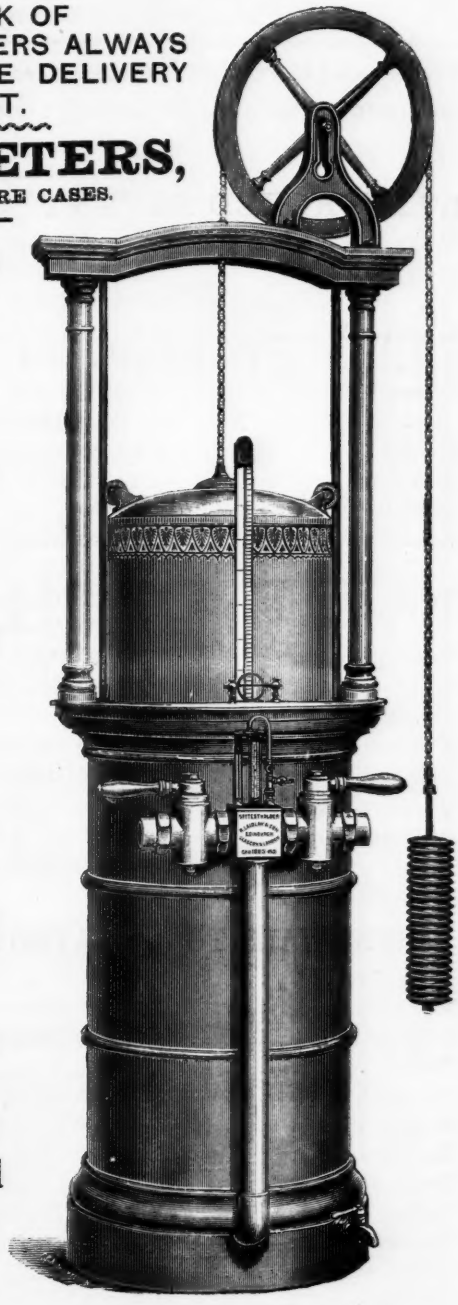

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Kensal Green	3,000,000	Cambridge	1,000,000	Lowestoft	500,000
,,	3,000,000	West Bromwich	1,000,000	Newton-le-Willows	500,000
Liverpool	3,000,000	Luton	1,000,000	Manchester	400,000
,,	3,000,000	Alger (Algieria)	875,000	Erfurt (Germany)	400,000
Croydon	3,000,000	Valencia (Spain)	875,000	St. Chamond (France)	350,000
West Ham	3,000,000	Barcelona (Spain)	875,000	Santander (Spain)	350,000
Rochdale	3,000,000	,, ,,	875,000	Atlas Steel Works, Sheffield	250,000
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Melbourne	1,500,000	Halle (Germany)	600,000	Baccarat (France)	175,000
Charlottenburg (Germany)	1,500,000	Elberfeld ,,	600,000	Hitchin	150,000
Derby	1,500,000	,, ,,	600,000	Sydney	100,000
,,	1,000,000	Nancy (France)	525,000	Balson-Chateauroux (France)	70,000
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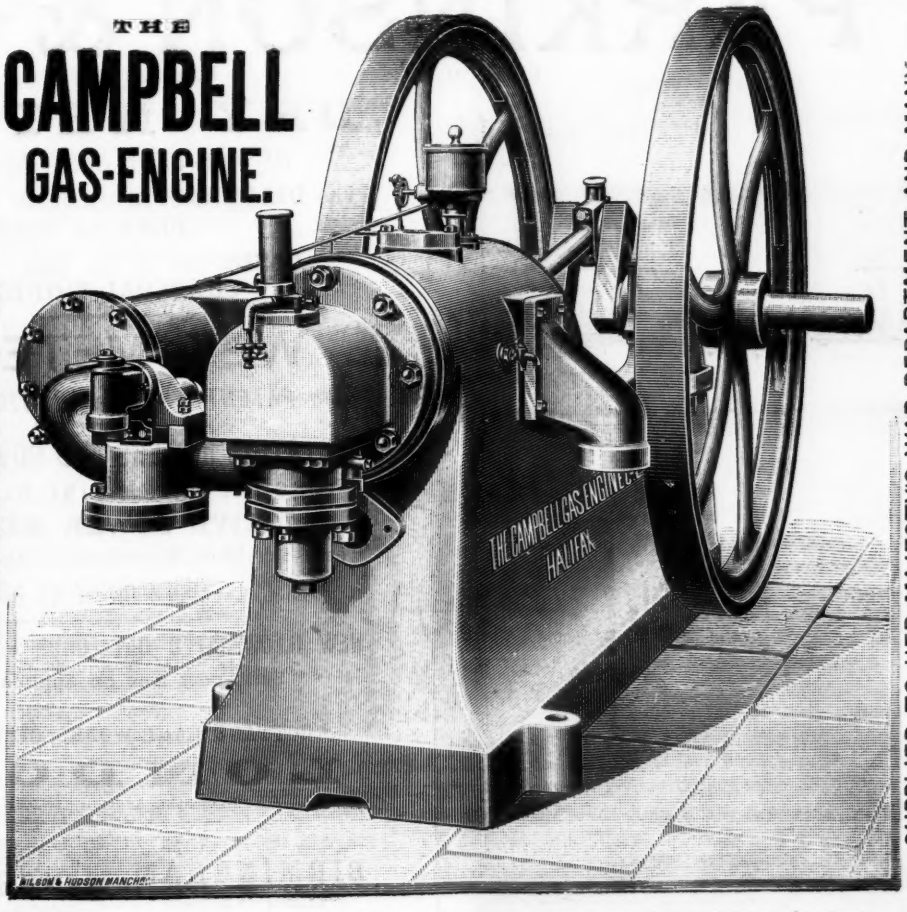

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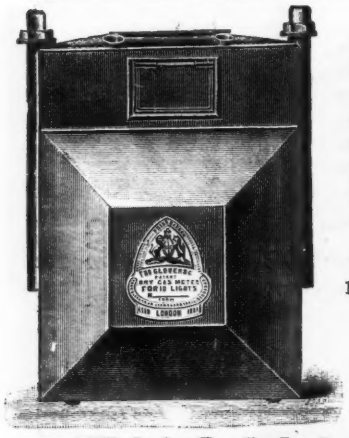

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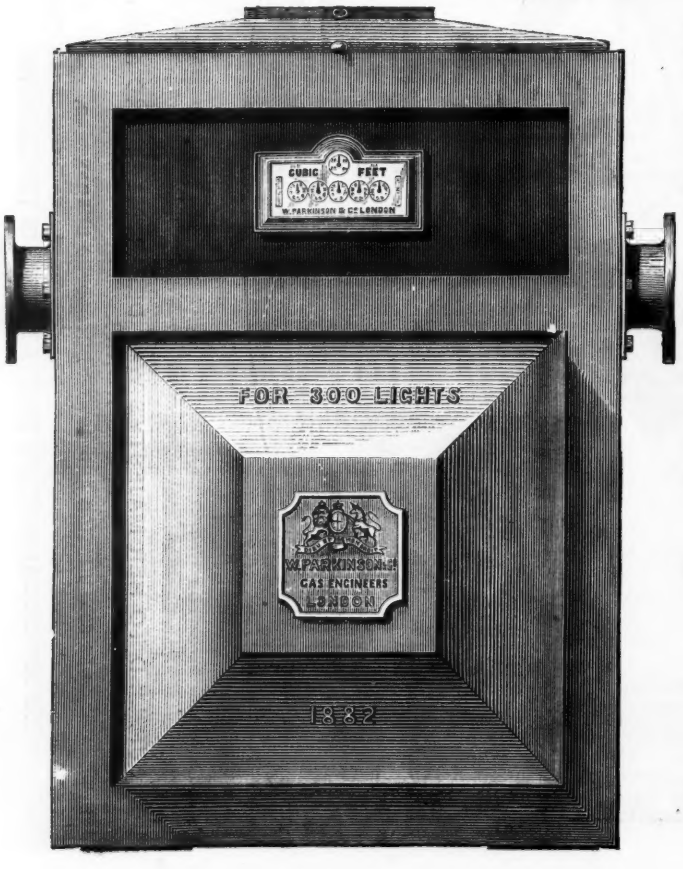

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, AUGUST 16, 1892.

"Smokeless London."

As will be seen in another column, that amiable theorist and amateur of gaseous fuel supply, Mr. Lynn Cyril D'Oyle, whose really interesting article in the *Gentleman's Magazine* upon the subject of the prevention of London fogs was recently noticed at some length in the JOURNAL, is anxious for further discussion of the topic. We are very glad to oblige him in this respect, and desire to assure him and all other non-professional gentlemen who may at any time manifest an intelligent interest in gas supply, that our columns are open to every reasonable contribution that is offered towards the solution of those problems which still surround the great national industry with which we are identified, and which appear to stand in the way of its fuller development as an aid to progressive material civilization. Mr. D'Oyle is a very pleasing writer, both to read and to criticize. He does his best to state his views in good language; and he bears criticism in the best possible temper. We should like to take his letter paragraph by paragraph, and reason with him at as great length as he could wish; but considerations of space forbid this. Before dealing with the letter itself, however, we wish to express our unfeigned pleasure at the appearance, in periodical publications intended for general reading, of such articles as the one to which we owe the gratification of making Mr. D'Oyle's acquaintance. The more gas supply is brought before the public by disinterested persons, who have no business purpose to serve, the better it must be, both for the industry and the community. Every industry, manufacture, or branch of trade has at least two aspects—that of a money-making occupation, and that of a public service. The latter is, of course, paramount. No regard for its value as a source of profit is entertained by any civilized community in the case of an industry which stands condemned as prejudicial to the general interest. An occupation which is a mine of wealth to those connected with it, is suppressed and proscribed from the moment when its effects are seen to be injurious to the community at large. It is natural, therefore, for those who are identified with an industry to proclaim on all proper occasions its claims to respect on other grounds than that of private interest; but, as Mr. D'Oyle very fairly points out, this kind of testimony is "suspect" by the world, which lends ear more readily to the cry "there "is nothing like leather" when the assurance does not come from a cordwainer.

It is not surprising that, after duly weighing the objections that can be brought against any project of centralizing gas production with reference to the coal pits rather than to the districts of consumption, Mr. D'Oyle finds his original position untenable. We cannot pass over without protest, however, his "parting shot," conveying the insinuation that the fact of "something "over 20 millions of money" being invested in London and suburban gas plant and machinery is "a greater "argument of the impracticability of the scheme than if "Durham were bounded on the south by the Rocky "Mountains." The existing establishments for manufacturing gas locally are doubtless a strong argument against all "root and branch" schemes of gas supply according to other methods. But, in our judgment, the "fact" asserted by Mr. D'Oyle is not the most important obstacle in the way of such a project as he has again brought before the public. If the project were really feasible, there would be no difficulty in having it carried out by the existing Gas Companies, or by a union of them. All their distributing, regulating, and storing plant would be good, wherever the gas came from; and seeing that the actual gas consumption of London, big as it is, will probably be doubled in the next 25 years, all the increase of the carbonizing plant, and the renewals of the old as it wore out, could as well be arranged for at one place as at another. We come back to the main question, therefore, of whether the thing is worth doing at any price; and there is nothing to show that Mr D'Oyle has properly appreciated even the single piece of evidence to the contrary which the Durham strike supplies. It is highly complimentary on his part to tell us that he cannot gainsay our "authority" in pronouncing adversely to a centralizing scheme of gas production. But neither the JOURNAL nor any other individual, or organ of opinion, possesses the slightest "authority" apart from knowledge of facts; and we aim at convincing Mr. D'Oyle rather than at overawing him.

As Mr. D'Oyle very properly says, however, the question of popularizing gaseous fuel, as an aid to rendering London smokeless, does not hang upon the removal of the gas-works to Durham, or anywhere else. There can be no questioning the main truth that, so far as human knowledge can at present help us, in gas, and in gas alone, lies the nearest and best remedy for the plague of black fogs which renders life in London so penible during at least four or five months of every year. It is within the power of most town residents to help to mitigate the evil, not merely without sacrificing either money or comfort, but with positive advantage to themselves, by using gas for cooking purposes. And gas heating-stoves, within certain restrictions, are likewise very useful. Yet how long must

London, and England in general, wait for anything like a widespread realization of this truth? With Mr. D'Oyle's remarks upon the course of the gas-stove trade we quite agree. A gas-stove salesman who cries up his own wares by disparaging those of trade rivals merely puts weapons into the hands of the enemy. Regarded as a scientific apparatus, the gas-stove is far from perfect; but we have to remember the fact that such stoves are made to sell, and that the interests of the manufacturer are not always identical with those of the gas maker, the sanitarian, or the consumer of gas. With regard to that bugbear of the sanitary reformer, the "pleasant open coal fire," we have recently expressed the opinion, which we now repeat, that the Englishman's traditional love for this luxury will probably endure until its gratification entails too great a tax upon his resources; and then he will drop it without saying anything about fog prevention. Coal at 40s. per ton would convert more householders to the cleanliness and economy of available substitutes for the open coal fire than any other argument that could be brought to bear upon them, not excepting an Act of Parliament.

Is Cheaper Gas to be Hoped For?

It is very desirable that the fullest notice should be taken of the decision of The Gaslight and Coke Company to abolish their cannel gas supply; and whether or not the example of Mr. Charles Hunt in writing to the Journal on the subject is copied, it is to be hoped that the responsible administrators of every gas undertaking in the United Kingdom will duly regard this important step in the development of gas supply in London as a "sign of "the times." Mr. Hunt, in his last week's letter, touched upon a most interesting aspect of this declaration of the future policy of The Gaslight and Coke Company. He reminds readers of these pages of the very different policy which stress of competition and other influences have conspired to impose upon Transatlantic Gas Companies. As we have repeatedly explained, the competition of the electric light has been interpreted by American gas engineers as calling for an enhancement of the nominal illuminating power of their gas. It has been stated by representative gas engineers that in many towns of the States they have been compelled to discard coal gas, and take to carburetted water gas of a higher illuminating power, because the former did not compare favourably with incandescent electric lamps. If there had been as much in this argument as appears upon the surface of it, would it not be a fair conclusion to expect a slower development of incandescent electric lighting in cities where the high-power water gas had been introduced? This appears to be Mr. Hunt's way of looking at the facts; and in what he describes as "an extension of electric lighting, which is "perhaps without a parallel in any other country," he sees an emphatic contradiction of the supposition that the candle power of the gas with which it may be confronted has any effect whatever upon the development of incandescent electric lighting. Here in England there is no evidence to show that electricians, in starting an installation, take the slightest notice of the illuminating power of the local gas supply. There is a flourishing Electric Lighting Company in Liverpool, which has one of the best of English gas supplies; and it is too obvious to need further illustration by the citation of examples, that, if 16-candle gas cannot prevent electricity from gaining a footing in our midst, 20-candle gas is equally open to attack. Wherein, then, consists the strength of British gas undertakings? It can only lie in the cheapness of their commodity. Gas is, of course, capable of many applications for which electricity is unsuited, although it is putting the case rather strongly for a gas engineer to say, as Mr. Hunt does, that "the future of gas largely depends upon its "adaptability for industrial purposes other than lighting." All the same, it is quite true, as he says, that in gas manufacture "it is the last candle that costs;" and if he did not happen to be a Corporation official, he would be constrained to add that it is the removal of the last 5 grains of sulphur that costs also. There is—there must be—a "very wide field for the employment of low-priced gas;" but this is almost wholly a question of cost. We must give up carburetting, if gas is to enter upon its inheritance. Even for lighting purposes, the possibilities opened up by incandescent burners point in the same direction as that in which lie the popular gas-stove and the economical gas-engine. Illuminating power, as tested by the photometer, is, to all intents and purposes, a convention of gas supply which, useful once, has served its time, and is now little more than a superstition. While the standard photometrical burner represented the best that could be done with a particular description of coal gas, it was doubtless well to insist upon its showing such a result as might be regarded in the light of a guarantee of the suitability of the bulk of the supply for the use of the community. Now, however, the consumer of gas for lighting purposes, by varying his burners, can make his gas show any illuminating power he chooses; while the great and growing minority of consumers who want gas for a fuel or a source of power do not care one jot what its nominal illuminating property may be, so long as they can get enough of it, and at a reasonable figure.

Depend upon it, price is the ruling factor in any gas supply. If the Directors of The Gaslight and Coke Company think they will be able to return to a lower price for their ordinary supply by ceasing to make cannel gas, this is the right course to follow. There is more in a difference of price of 3d. or 4d. per 1000 cubic feet than there is in an alteration of 3 or 4 candles in the nominal illuminating power. If the Company could have acted in the other sense, and given their consumers 20-candle gas all round, nobody would have thanked them. Such a change of standard would mean very little to a user of gas-engines or to a business firm with hundeds of assistants to cook for. But to the former 3d. or 4d. per 1000 cubic feet in the price may stand for the difference between the cost of steam and gas power; while the quarterly bills of the latter would strikingly illustrate the difference. Cheapness is what gas makers must aim at—not to the sacrifice of legitimate quality and purity, of course. The consumer unquestionably has no use for either nitrogen or sulphur. Why he should be supposed to require an expensively carburetted gas, at an altogether disproportional cost, is fast becoming one of the problems of the age. We cherish no delusions, however, with regard to the way of deliverance from the burden of carburetting. Glasgow may do it; Edinburgh will do it; Birmingham need not despair of it. But London and Liverpool and Dublin will have to wait until somebody from without the circle of the gas interests extends a hand to help them to a low-priced article by removing the statutory restriction imposed for the sake of considerations which are fast growing obsolete. It will take time to educate our rulers up to the understanding of the altered conditions of the gas industry; and until this has been done, it will be suspected that, in asking to be allowed to sell cheap gas, the Companies have ulterior designs which may work out detrimentally to the body politic.

The North of Ireland Gas Managers.

The North of Ireland Association of Gas Managers met last Tuesday in Dublin; this being so far their most southerly migration. Next year it is intended to hark back to Coleraine. The President of the Association (Mr. D. M'Callum, of Omagh) having resigned the position in consequence of a family bereavement, Mr. W. S. Stormonth, of Coleraine, the Vice-President, was called upon to discharge the duties of the chair, which he did very creditably. His address was of a practical character. Two papers were read at the meeting—by Mr. P. J. Salmon, of Galway, and Mr. J. Robb, formerly of Limavady and now of Cinderford, respectively. The meeting was made more attractive and instructive by the Committee having arranged with Professor Tichborne for the delivery of a lecture on the bye-products of gas making. The programme of the meeting included a demonstration of the value of the Wigham system of lighthouse illumination by means of gas, as applied at the Howth light station; but, owing to the absence of Mr. Wigham, who has been attending the Edinburgh meeting of the British Association, this part of the *agenda* was not fully carried out. The meeting was fairly successful; but there is no indication that the remainder of Ireland is ripe for the nationalizing of the Association, which is a consummation devoutly wished by Mr. Stormonth and most of the men who constitute the strength of the present organization.

Unions and Unionists.

The reluctance shown by the conductors of the so-called Labour journals to report the proceedings of the Labour Commission, is at first sight a strange indication of apathy;

but there is very good reason for it in the extraordinary character of the evidence given by some of the professional spokesmen for the New Trade Unions, which is calculated to make these men and their supporters the laughing-stock of the rest of the community. It has been recorded how Mr. W. Thorne has expressed himself in favour of allowing mob-law to settle trade disputes; but it was reserved for one of his subordinates among the paid leaders of the Gas Workers' Union to talk greater nonsense before the Commission than has yet been listened to by this exceptionally patient body. The performer in this instance is the chief of the Plymouth branch of the organization; who, before he managed to attain to the conspicuous office of a paid agitator, earned an honest, if somewhat more laborious living as one of the Beckton "purifiers." They all come from Beckton, these lights of labour. This gentleman has had a chequered experience since he was chosen to play the part of meddler-in-general for all the rough industries of South-Western England. To be fair to him, he appears to have amply justified his appointment; going about among brickmakers, shoemakers, and wherever "unorganized" labour was to be met with, fanning discontent, and founding branches of the Union. His reward was not long delayed. Strike succeeded strike upon his footsteps; and although employers manifested deplorable reluctance to "recognize the Union"—that is, to receive him as of equal authority with themselves in the management of their business concerns—still matters progressed fairly satisfactorily, and in many instances wages were advanced, for which result, of course, the Union official claimed all the credit. But then there came a painful illustration of the ingratitude of mankind, which has been declared by a poet not unknown to fame as "sharper than a serpent's tooth," and as more unkind than the wintry wind. Having secured their advances of wages, the members of the newly-founded branches of the Gas Workers' Union considered the utility of this institution to be ended, so far as they were concerned; and, with remarkable unanimity, they declined to continue to pay their weekly threepences—thus not only insulting the sacred cause of Unionism, but also imperilling the source of sustenance of that more sacred person, the paid Union Chief. Clearly, such behaviour is "most tolerable and "not to be borne," as Master Dogberry has it. And the remedy for this treasonable conduct which occurs to the Plymouth leader is, as he told the Commission, that wherever it is proved that a body of workmen have obtained an advance of wages through the intervention of a Trade Union, they shall be compelled to continue their membership of such Union upon pain of having their wages reduced to the former rate! How this is to be done, and what is the nature of the proof to be established in any case, are, of course, details which do not affect the principle contended for; but an Act of Parliament would probably be the specific relied upon for settling these and all cognate questions. So childlike is the faith of the agitator in that "old Father Antic, the Law," if he is to be permitted to pull the strings! Once more, as in the case of the Liverpool Union Secretary recently referred to, the Law is to be enforced or not, according to Union requirements of the moment.

The Plymouth gentleman is not the only one who complains of the difficulty of keeping up the membership of the New Unions. Mr. W. Thorne, speaking at the recent anniversary meeting of the Gas Workers' Union, remarked that he was sorry that "a great many men who "had obtained higher wages and less hours through its "means had fallen away from it." But what would you have? If any organization is declared from its inception to be designed for one purpose, and for no other, it is tantamount to an invitation to connect its duration with that of its apparent usefulness. There are plenty of social movements which, after running their appointed course, are brought to a conclusion with the assent of all concerned. Now the New Unions in general, and the Gas Workers' Union in particular, have always proclaimed themselves as purely "fighting" bodies. They did not lay themselves out to play the part of sick or benefit societies, but were intended for the purpose of facilitating strikes for higher wages and shorter hours of labour. This being its object, it is obvious that there can be no other ground for the formation of a branch of the Gas Workers' Union anywhere than the existence of some dissatisfaction which it can be invoked to help remove. Once get the *casus belli* satisfactorily disposed of, with or without fighting, and what is the justification for the continued existence of the branch? It may be said that those who have appeared to benefit by the services of a professional agitator ought to continue to support him for the sake of his prospective exertions on behalf of others; but it is hardly to be wondered at that the raw levies of the New Unionism "do "not see it." Not at all badly adapted for guerilla warfare, the New Unions want some more persistent purpose than mere fighting, if they are to survive as permanent organizations. Mr. Thorne has begun to understand this, for we find him telling his supporters the other day that lately his Union has taken up the insurance of members against accident, and the enforcement of claims under the Employers' Liability Act. This is perfectly right and proper; and if the Gas Workers' Union had done nothing worse, we should have applauded instead of censuring its leaders. It is plain now that the practical operation of the Union under its original form of government was calculated to bring the cause of Unionism into contempt. Unlimited power over the means of livelihood of their fellows was seized by a group of badly-informed, passionate men, some of whom doubtless had good and honest intentions, but others were certainly scamps. These men made sad havoc in South London, Manchester, and elsewhere; and when their failure was brought home to them, there was always some loophole for their escape. In short, the Union never took the whole of the responsibility for a disaster, but always claimed credit for every success. It also pretended to credit for triumphs with which it had in reality nothing to do. We have remarked that all the chief agitators among the gas workers come from Beckton; but lest we should be misunderstood as implying that this result is due to any exceptional hardness in the treatment of the Beckton men, we desire to refer to the statements to the Labour Commission of Mr. W. James, a typical Beckton man, who has worked for The Gaslight and Coke Company since 1877. This witness corroborated what had already been put upon record respecting the offer of eight-hour shifts to the London gas workers ten years ago, and the refusal of the proposition by the men. It is clearly absurd, therefore, for the Gas Workers' Union to claim any credit for the invention of this division of the working day in London. In Liverpool, as is well known, it has been the rule for upwards of thirty years. What the Union did in the matter of the eight-hour shift was therefore no more than forcing an open door—not a great achievement to be celebrated by annual meetings, and little enough to serve as the basis of the reputation of all the agitators who make use of it for this purpose. What the Union did *not* do comprised the prevention of non-unionists from obtaining employment, and the getting of another shilling a day for its members; and these were its true objects. It would be too much to expect the achievements of these and minor failures to be commemorated by mass meetings and processions. They are facts of history, however, which have to be taken into account in any comprehensive review of the Gas Workers' Union. Mr. Thorne is not the man to forget them; and he is bent upon directing the Union into new courses while yet it hangs together. In this he is wise; but it remains to be seen whether he is "wise in time."

The Brussels Municipality and Electric Lighting.—We learn from correspondents in Brussels that, after much inquiry and discussion, the Municipality have at last settled their electric lighting scheme. It is to be entrusted to the India-Rubber and Gutta-Percha Company, of Silvertown, who are to be paid 2,500,000 frs. for a first installation. This decision, which is in accordance with the recommendations of a Special Committee, was arrived at on the 4th inst.; but, as far as we can understand, it was come to without having any definite details as to the project of the Company. Under such circumstances, it is doubtful if the city will be provided with a really economical installation. It now remains to be seen what the successful tenderers will do. Protests were entered by two of the competing firms, that their prices had been put up something like 30 or 40 per cent.; and other charges of a rather serious nature are in the air. It is regrettable that the later phases of this question should have been marked by unpleasant circumstances, involving the reputations of certain parties; and it is to be hoped that litigation may not follow the prolonged deliberations which have resulted in the final arrangement.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 316.)

THERE is no change to be noted in the position of affairs in the Stock Exchange. The business of the week was the settlement; and that was a very light matter, and simple of adjustment. Apart from this, fresh business was at a low ebb. The holiday season is well advanced; and there is no counter-attraction to tempt people into Capel Court. The markets have thus been very inanimate; and prices have not been subject to any movement of note. The chief feature perhaps was some demand for high-class securities for investment; and this was apparent in the buoyancy of the Water Companies' debenture stocks. Whatever may be the degree of apprehension entertained as to the treatment their shareholders may expect from the London County Council and the "Programmists," the position of the debenture stock holders, as creditors of the undertakings, must be safe enough. The Money Market continues without any sign of change. The Gas Market has been very quiet, as was to be expected amid the general inactivity. But it is decidedly firm; and all quotations which have moved at all have gone up. A single exception to this is owing to special causes in connection with the price of silver. Gaslight "A" opened well; but the best prices were not afterwards fully maintained. The quotation, however, on *ex div.* adjustment does not show any diminution. Nearly all the debenture, preference, and limited issues are higher; the greatest gain being a rise of 2 in the 10 per cents. South Metropolitans were in good demand; and all three issues are higher, in view of the results of the half-year's working shown in the accounts. It is satisfactory that, notwithstanding the notoriously adverse conditions besetting that period, the Company have earned their dividend all but the relatively inconsiderable figure of some £6000. Commercials have been quite lifeless; not a single bargain being marked in them. Among the Suburban and Provincial division, the only one to make a move was Brentford, which is a little higher *ex div.* The accounts of the Bromley Company show that their earnings are only about £600 short of the amount required to pay the old rate of dividend, which is a very fair result. Far different is the statement of the West Ham Company. By taking a further £2500 from their reserve fund, they will just be able to pay an 8 per cent. dividend, which rate is 2 per cent. lower than the last. The prospect is not pleasant. The Continental undertakings continue firm; and Imperial is 1 higher. Of the rest, nothing moved but Bombay, the new shares of which receded ¼. The Water Companies were quiet and steady, with a general tendency to improvement in the debenture issues.

The daily operations were: Gas opened very firm on Monday, and continued so for the most part. South Metropolitan "A" rose 2. But British fell 1; and Bombay new, ¼. On Tuesday, all issues remained without further variation. Wednesday's business on the whole showed the same tendency, though a parcel of Gaslight "A" was "specially" done very low. Gaslight 4 per cent. debenture and South Metropolitan "A" and "B" advanced 1 each. New River debentures also rose 1. Thursday was extremely quiet; but British regained 1. Friday was equally inactive; but everything was firm. South Metropolitan "C" rose 5; and Imperial Continental, 1. East London debentures rose 1¼. Several Gas and Water stocks were quoted better *ex div.* Saturday's business was unimportant; and all quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

Random Tendering for Electrical Work—Mr. A. Colson and the Leicester Electric Lighting Scheme—The Standard Municipal Price for Electrical Supply.

ELECTRIC lighting, as its professors are always ready to assure all inquirers, has long since passed the "experimental," and entered upon the "commercial" stage of development. Yet the other day, when the London County Council asked for tenders for the electric lighting of the Claybury Asylum, the tenders varied in amount from £13,970 to £28,400. Both the highest and the lowest tenders came from thoroughly respectable firms—to either of whom we should have thought it would be quite safe to give an order for any description of electrical work without preliminary haggling about price; while some other firms to whom we should have ascribed a more speculative character were safe about the middle of the list. Electric lighting contracts are not the only ones which evoke random tendering; but a difference of 100 per cent. in the estimates of cost of a job which must be very largely made up of common shop-work, is assuredly somewhat remarkable. So long as there is this uncertainty respecting the value of wiring and lamp fitting, it will be somewhat difficult to apportion blame for careless and scamped work of the kind merely because it happens to be low priced. Many firms of gas-fitters and mechanical engineers now have electrical branches; and the price of fittings, &c., is certain to be cut down. By the way, the fact that with due care, even a temporary electric lighting contract can be carried out without danger of fire, is illustrated by the example of the Crystal Palace Exhibition, the wiring for which was done under the supervision, and according to the rules, of Mr. Musgrave Heaphy. An additional fire-risk was charged on this occasion by the Fire Offices; but Mr. Heaphy records, with pardonable pride, that there was not a single alarm, of fire in connection with this installation during the whole time of the Exhibition—a result which is highly creditable both to the supervision and to the contractors.

The Corporation of Leicester are in receipt of tenders for the electric lighting of the special area in the centre of the town required in their Provisional Order to be first supplied. The specifications for the work have been drawn up by Mr. Alfred Colson, who has thus been induced to add to his already varied and extensive responsibilities in connection with the management of the gas-works, &c.—a charge which will still further test his ability as an "all-round" engineer. We have no doubt that Mr. Colson will do his fresh work as well as he has done that to which he may be supposed to have been more accustomed; and if the Council of the Institution of Gas Engineers are sufficiently alert, they may possibly be able to obtain from Mr. Colson an instructive paper on electric lighting, as viewed from the standpoint of a Corporation Gas Engineer, for their next annual meeting. It is eminently desirable that such a memoir should be obtained at the earliest possible moment, for the guidance of a class of professional men which is even now fairly numerous, and which may be supposed to become more so every year; and there is no engineer to whom reference for such information would be more fruitful than to Mr. Colson.

It appears to be fairly well settled, as a point of contemporary practice, that 6d. per unit is the proper price to be charged for electricity supplied from a municipal central station. Whether the business will pay at this rate is a question which can only be answered by experience prolonged over a sufficient period. It is a fundamental condition of the attainment of such success as there may be in store for installations of the kind, that prospective consumers shall have some degree of certitude in the matter of the selling price. A large electric lighting business must be a plant of slow growth anywhere; and suppliers must be prepared to wait a weary time before seeing their money back. Meanwhile, their patrons make all sorts of comparisons of the light with that to which they have been accustomed. In one sense, all such statements of the comparative cost of electric and gas lighting as those with which consumers are amused by contradictory advisers, are pointless. Every consumer will find out from his own experience as much as he wants to know. Whatever may be the idea with which he starts—whether he has fallen a victim to the delusion that by patronizing electric lighting he will save money, or is quite prepared for doubled and tripled lighting bills—with every succeeding quarter his information on the subject grows more precise; and after a year or two nobody can tell him anything worth knowing about it. It is obvious, however, that while these comparative studies are in progress, any disturbance of the data relating to the unfamiliar article of consumption must be extremely prejudicial to its chances of receiving impartial treatment. If oscillations of price are detrimental to gas consumption (and there can be no doubt of this being the case), they would be vastly more inimical to the consumption of anything respecting the value of which so much remains to be learnt, as with electric lighting. Sixpence a unit is a good, plain figure, and sounds much less than gas at 6s. per 1000 cubic feet, which is the equivalent cost of light for light. There is every reason to believe that some municipal central stations may be made to pay at this price; but all those that have started must be nursed out of the rates or the gas profits until they do.

The Gadd and Mason Appeal.—The proceedings in the appeal of Messrs. Gadd and Mason against the judgment of Mr. Justice Kekewich, in their action against the Corporation of Manchester, partly reported in the JOURNAL last week (p. 255), were continued on Tuesday and Wednesday. At the close of the arguments, their Lordships reserved judgment.

The Management of the Oldbury Gas-Works.—At the last meeting of the Oldbury Local Board, the Gas Committee presented a report in which they referred to Mr. C. Meiklejohn's resignation of the managership of the gas-works, in order to take the position of Engineer and Manager of the Rugby Gas Company, in succession to Mr. P. Simpson, and expressed to him their hearty congratulations on his success. They recommended that Mr. Adam Cooke be appointed General Manager and Accountant at the gas-works; and this was agreed to.

The British Association and Underground Waters.—In the Chemical Science Section of the British Association, Mr. C. E. De Rance read the eighteenth report of the Underground Water Committee, of which he has been Secretary since its formation. After referring to the importance of the purity of this source of supply for domestic consumption, he laid stress on the care that should be taken in the selection of the sites for wells and borings, so that there might be no possibility of surface percolation. He also exhibited a map showing the adjustment of county council districts with river basins, prepared by him for Mr. J. Brunner, M.P., for presentation to the county councils and county boroughs of England and Wales, and dedicated by permission to the then President of the Local Government Board (Mr. Ritchie).

TECHNICAL RECORD.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

The Annual Meeting at Stirling.

We complete to-day our report on the proceedings at the above meeting, by giving the discussions on the papers read by Mr. J. Mackay, of Peterhead, and Mr. G. Keillor, of Nairn, which appeared in the JOURNAL last week (pp. 250, 252).

DISCUSSION ON MR. MACKAY'S PAPER ON ENRICHING COAL GAS.

The PRESIDENT (Mr. A. MacPherson, of Kirkcaldy) said the subject dealt with in the paper was one in which the members were all deeply interested. Mr. Mackay had put the question very fully before them, and given them his results. He (the President) was sure Mr. Mackay would be pleased to reply to any questions they might ask him.

Mr. T. D. HALL (Montrose) said he felt quite incapable of doing justice to Mr. Mackay's paper. He thought it was one they would all be the better for considering, as they did some months ago. It was full of figures, and would improve very much by reading. It was on a matter about which he (Mr. Hall) knew very little; but it seemed to him that Mr. Mackay had gone very deeply into the subject. He appeared to have settled a great doubt they all had as to the permanency of oil gas. He had subjected such gas to a very severe test indeed—viz., passing it through small pipes submerged in ice and salt, which no other gas, as far as he knew, was required to do. He was agreeably surprised to find Mr. Mackay obtained the results he had recorded—viz., that the percentage of hydrocarbons remained the same after these severe tests, and that, too, after the gas had been kept in the gasholder for about a fortnight. The high illuminating power which Mr. Mackay seemed to be able to obtain from common Scotch oil was a surprise to him (Mr. Hall). He had gas of 50-candle power—the gas they were accustomed to see in railway carriages; and when they considered the very small burners used, they would have some idea of the richness of the gas. He would very much like the paper to be discussed at a future meeting; and he thought the members might consider whether they could not do this.

The PRESIDENT said it would be well to hear what the members had to say in the meantime; and if they wished to have a further debate after studying the paper, he would be pleased. He thought they could have a discussion upon it then, because some were deeply interested in the subject of oil.

Mr. HALL asked leave to make one more remark. He said he noticed in one of their publications a remark about the expenditure for coal at Peterhead; and he considered, in fairness to Mr. Mackay, it should be explained in this way: Mr. Mackay showed an increase upon his expenditure for coal during the past twelve months, notwithstanding the use of oil, of, he thought, £66. At first sight, this might appear to be not very flattering to Mr. Mackay's management; but if they compared some of the other accounts for coal with that gentleman's —take his own, for instance, for he had spent on coal in the past year £460 more than he did in the preceding one—they must give Mr. Mackay credit for only requiring to spend £66 more. If he had not used oil, the possibility was that he would have had to lay out an additional £300 at least on coal.

The PRESIDENT said he suspected Mr. Mackay laboured under the great disadvantage of being a pioneer in respect to the use of oil for enriching purposes, and that the members were not able to criticize him. At the same time, they were indebted to him for his very able paper; and he had no doubt when they had read it through in print, they would be in a better position to discuss it. They could give it a place on the *agenda* next year. It was a subject that was well worthy of being so treated. A gas that would submit to a pressure of 150 lbs. per square inch with only a very slight fall of something like 6-candle power, must be, for all practical purposes, regarded as a thoroughly permanent gas. He did not suppose there ever was very much dubiety as to the permanency of gas made from oil; it was more a question of the permanency of gas made from shale. On this point, he believed, doubt still existed. They were still uncertain as to whether they could carry the illuminating power from the gas-works to the consumer's burner, or whether it would not condense in the mains. Mr. Mackay had taken 2 per cent. by which to divide his durability; and he (the President) believed this would turn out to be about correct. He thought Mr. Mackay might safely assume that dividing the durability by two would give him the candle power of his gas; for he himself laid before the members some years ago, when sheets of analyses were not so extravagant as they were now, a communication in which he showed that this division was the right way of arriving at durability. Mr. Mackay had also brought out the important matter of the saving of 4¼d. per 1000 cubic feet of gas. This was a very material saving, and one which they would all like to be able to effect. There was no doubt the present price of cannel coal was very high; and it was likely to remain so if the foreign demand continued good, because they could not expect coalmasters to throw away their coal to them if they could sell it at a good price. If Mr. Mackay, who was so far removed from the coal-fields, could save 4¼d. per 1000 cubic feet of gas, there were others almost equally badly situated who could do it also. Another thing he brought out was the profit he was making from coke. If he could, by using the inferior cannel, get good coke, of course his revenue from this source would increase. He wished to compliment Mr. Mackay most heartily upon his paper; and he expressed the hope that it would suit him to have the discussion taken after the members had had time to thoroughly master the subject. He would like to call upon Mr. Tocher, of Peterhead, who, he believed, assisted Mr. Mackay in the analyses of his tar and other matters, and could give some idea of the value of the tar that was derived from the oil.

Mr. J. F. TOCHER, A.I.C., F.C.S. (Peterhead), said it was only through the indulgence of the members that he could be allowed to say anything there in connection with the very interesting subject of the economical enrichment of coal gas by means of shale oil. The excellent and readily applicable method of gasification introduced by Mr. Mackay would enable gas engineers to have a quick and a thorough control over the oil; and it was satisfactory to note that, so far as his works were concerned, the object in view had been attained. He had shown them that it was possible to raise 20-candle gas by 4 candles, using ordinary fire-clay retorts. Regarding the reason why a certain percentage of oil gas should fail to raise the illuminating power further than a much lower percentage, no definite statement could be made at present. Professor Lewes, who had been conducting a series of experiments, found that it was impossible to calculate the quantity of enriching gas necessary to produce a good illuminating value, without considering the composition of the gas to be enriched. It was known that carbonic oxide tended generally to reduce the illuminating power; and Professor Lewes had found that, mixed with hydrogen, it exercised a reducing influence out of all proportion to the percentage present. This fact, together with imperfect explanation, might partly account for the defection; but it was notwithstanding remarkable that the results obtained by Mr. Mackay corresponded so nearly with their theoretical value, seeing that the experiments were conducted throughout on a working scale, in contradistinction to what he had seen hitherto published, all of which had been made in experimental retorts. From a scientific point of view, it was to be regretted that, owing to want of experimental works, there was no possibility of obtaining a sample of the tar produced while using Mr. Mackay's method. It might differ from other paraffin tar, owing to the higher temperature employed in gasification. Of the composition of the tar very little appeared to be known. Professor Armstrong had stated that it contained only a small quantity of benzene; and in a paper recently read before the London Section of the Society of Chemical Industry* Professor Lewes gave the quantity of benzene present in petroleum tar naphtha as 19 per cent. From the results given in Mr. Mackay's paper, the members would note that, without going into a complete chemical investigation of paraffin tar naphtha, but simply making an examination for technical purposes, they found 37·7 per cent. of 90 per cent. benzol, of specific gravity of ·879. He communicated with Dr. Mills on the subject; and although he was unable to give exact particulars as to paraffin tar, he stated that, "when the oil was led through Taylor's or similar retorts, there was no difficulty in converting it almost wholly into aromatic tars and gas, provided the operations were carried out slowly, and at a very high temperature." From this, it appeared that the presence of non-nitrifiable oils in the tar, and the getting by the distillers of aniline colouring matter, were possibly to be avoided; and in order to prevent their formation, the oil must be slowly gasified at a bright orange heat. As Mr. Mackay had told them, the colour of the foul gas gave an indication as to whether or not the oil was properly decomposed. This was rather important, for when the colour was white they might be sure the tar as well as the yield of gas, and consequently the illuminating power, would be very materially affected. As was well known, the market value of the tar was so low that he supposed it was quite immaterial to gas managers whether or not it was affected by paraffin tar. He was quite sure, however, that neither the gas manager nor the distiller need have any fear; for when complete gasification was attained, the quantity of oil necessary to enrich coal gas was very small indeed.

The PRESIDENT said he thought that, in conjunction with Mr. Mackay, Mr. Tocher was entitled to a hearty vote of thanks for giving the members the benefit of his experience.

It was then agreed that the discussion of the paper should be taken at the next meeting of the Association.

Mr. MACKAY thanked the members for the kindly way in which they had received his paper, and for the very high honour they had done him in putting it back for discussion. There were, he said, many problems to be solved in connection with enriching gas by oil; and possibly by next year some of the members might be able to help him. Several points had been mentioned upon which he had intended to touch; but he thought that, under the circumstances, it was better to leave them till the next meeting.

DISCUSSION ON MR. KEILLOR'S PAPER ON KEEPING DOWN CONSUMERS' COMPLAINTS.

Mr. J. B. TERRACE (Brechin) said the matter dealt with in the paper was one of which all the members had had experience

* See JOURNAL, Vol. LIX., p. 1183.

Each had his own way of settling his difficulties; and whether or not they approved of the mode practised by Mr. Keillor, they must give him credit for his paper. When people made a complaint to him (Mr. Terrace) about their gas bills being high, he generally had the previous quarter's reports with him, and he told them exactly what they were; and it often turned out that, instead of being more, they were really less. He found that the younger folks were worse to deal with than older ones. Those who had burnt gas in its early days felt they were, in a sense, under obligation to the gas company; but the younger people considered they were the masters, and the gas company the servants. A great source of complaint which Mr. Keillor did not touch was that the servants in large houses sat up late, and consumed gas unknown to their employers. His advice was to have a separate meter for the servants' bedrooms. This, however, was not very easily done. He knew certain cases where gentlemen in good positions, when making a change of servants, shut off the gas supply to their bedrooms; and he (Mr. Terrace) found that, if this was done, it saved a great deal of trouble, even supposing he lost in consumption of gas.

Mr. T. D. Hall (Montrose) said he was very pleased to hear the paper. The satisfying of certain classes of grumblers should almost be classed among the fine arts. Servants of gas companies could not afford now-a-days to be so independent as they were in the old times, because there were so many different sources of light to compete with. It was hard for a gas manager to supply (say) 27-candle power gas, and go to the house of a grumbler and find only a 15-candle light developed, by reason of a bad burner and defective fittings. He very often put these matters right at the expense of his Company; and he thought, in the long run, it was better for them to spend a few shillings in this way. It was very often at the communication with the meter that the fault lay; and if the meter were connected by their own tradesman, they got rid of a large number of complaints.

Mr. P. Watson (Stirling) said that in his young days he used to experience a great deal of difficulty and contrariness with people who had not the money to pay their accounts. Those who had not the means, and were "stiff" in payment, used to complain; while those who paid promptly for their gas had no complaint at all to make.

Mr. J. Ballantyne (Rothesay) said the members were much obliged to Mr. Keillor for his paper. They had been in the habit, in Rothesay, of carrying out, to a certain extent, a system of dealing with complaints on the spot. Their inspector had instructions to take note of everything; and immediately the survey was made, he was sent back to repair any defects. As a rule, they tried to get the proprietor or the factor to keep the fittings right; and the consequence was that they did not interfere with the survey of the meters. Their policy had had this effect, that he was sure that for more than twelve months he had not had a single complaint about the quality of the gas he supplied.

Mr. J. Whyte (Seaham Harbour) said he was glad there were grumblers in the North. It appeared that the Scotch people complained as people did in England. At Seaham, they managed to stop grumbling considerably by employing their own gas-fitter to put in the pipes. He knew from experience that complaints were often the fault of the ordinary gas-fitter. Fortunately for him, they arose in two of his Directors' houses; and when a gas-fitter was called in, he said the fault lay in want of pressure and inferior quality of gas. His Directors naturally spoke to him on the matter, and he sent a plumber from the works, with instructions to clean out the fittings thoroughly, and the cause of complaint was removed. The same thing occurred in other cases. The Directors saw that something had to be done; and they passed a resolution to employ another gas-fitter, and send round the town a circular stating that they were ready to undertake the repair of gas-fittings. This stopped complaints; and for a hundred that occurred before, he had not one now. The strangest thing of all was that he had not had a gas-fitter in the works for four or five months.

Mr. R. S. Carlow (Arbroath) thought the members were much indebted to Mr. Keillor for the paper he had read. He had brought forward some very nice points as to how complaints should be grappled with. Mr. Keillor went on very much the same lines as they did in Arbroath, where they had a book in which they regularly entered the date, the name and address of the complainer, and the person's name who attended to the matter, and how it was rectified. They scarcely had any serious complaints now. It was an instruction to the meter inspectors to see that any complaints were attended to without calling in a plumber.

Mr. T. D. Hall asked to be excused for speaking again, but he thought with Mr. Whyte that gas companies should have control of the gas up to the point of combustion. This was what they had in Montrose, so far as they could.

Mr. J. Carmichael (Barrhead) said Mr. Keillor's paper had been very interesting to him. He thought the spirit the writer had shown suggested that which should actuate other gas managers. There was one thing he had always advocated, and that was to supply burners free in every case where they could not get paid for them.

The President said he quite agreed with Mr. Keillor that this was as important a subject as some of the more scientific ones brought before the members, because it lay to their hand every day and every hour of the day. It did not matter what kind of gas they made and sent out, if they could not get their customers to consume it properly, they would have complaints. There were reasonable grumblers, who had some cause for it; but there were also unreasonable ones—people who could not do without grumbling. They could almost in every case show that it was not the quality of the gas that was wrong, but that it was some simple thing that required a little attention. But really he did not know anything to which people paid less regard, and in which they would do so little to help themselves. Consumers seemed to think that all they had to do was to put a light to the gas, and then there would be an illumination, no matter if their burners had been in use for ten years, and their fittings be fifty years old, and had never been cleaned. Gas managers should gain the confidence of the consumers, and then they would find that a great many complaints would disappear. He had one case of a factory proprietor who had newly come into the town, and was depreciating the gas. He (the President) called upon him, and at once saw that the man had good reason to complain, but that he could not discriminate between a defect in the fittings and bad gas. A gas-fitter, in doing some repairs, had disconnected a 3-inch pipe; and, in order to keep the gas off while he was doing his work, he put a lump of waste into the pipe, and had neglected to take it out when he had finished the job. The members had no idea of the difference which careful domestic servants could make in the gas account. A gentleman came to him with a complaint. They examined the meter and fittings, and found he had just reason for grumbling. He was 50 or 60 per cent. up. Nothing could be seen that was wrong. After a few days, however, it occurred to him (the President) that it might be the servants; and he told the parties to watch. They did so, and discovered that their newly-arrived servants were in the habit of lighting up all the rooms in the house before they began to clean; and only putting any out when they had finished their work. These were matters they would always have with them. They must simply bear them as best they could; and the more they were able to do this, the more satisfaction they would give.

Mr. Keillor having thanked the members for the manner in which they had received his paper, a vote of thanks was accorded to him for it.

Grants by the British Association.—Among the grants for scientific purposes recommended by the General Committee of the British Association at their recent annual meeting in Edinburgh, we notice the following: To Professor Carey Foster, £25, for electrical standards; to Professor Roberts-Austen, £10, for the analysis of iron and steel; to Professor W. A. Tilden, £20, for isomeric naphthalene derivatives; to Professor Hull, £5, for underground waters.

Stoppage of a Leak in a Water-Main.—The *Engineering Record* gives an account of an ingenious method adopted by Mr. Hugh F. Doran, Superintendent of the water-works at Port Huron, for stopping a leak in a water-main running under the Black River. The pipe, which was 16 inches in diameter, had been split for about 3 feet by a Government dredge. A half circle of wood, conforming to the outside diameter of the pipe, was made of 1½ inch by 2 inch strips, and in the form of a stave, fastened together at each end by a flexible band. On the inside of this wooden circle was tacked a sheet of ¼-inch rubber packing, and a sheet of light steel boiler-plate was placed on the outside in a similar manner. The patch was then laid over the break by the diver, and securely fastened to the pipe with 4 inch by 1 inch wrought-iron bands, made to the circle of the pipe, and drawn together by 1-inch bolts; the space between the bands being 7 inches. By this means the pipe was made perfectly tight, and has repeatedly withstood high pressure.

Magnesium as a Source of Light.—In an article on the above subject which recently appeared in *Nature*, Mr. F. J. Rogers gave the results of his investigation into this matter as follows: (1) The spectrum of burning magnesium approaches much more nearly that of sunlight than the spectrum of any other artificial illuminant. (2) The temperature of the magnesium flame, about 1340° C., lies between that of the Bunsen burner and that of the air-blast lamp, although the character of its spectrum is such as would correspond to a temperature of nearly 5000° C., were its light due to ordinary incandescence. (3) The "radiant efficiency" is 13½ per cent.—a value higher than that for any other artificial illuminant, excepting, perhaps, the light of the electric discharge *in vacuo*, for which Dr. Staub, of Zurich, has found an efficiency of about 34 per cent. (4) The radiant energy emitted by burning magnesium is about 4630 calories per gramme of the metal burned, or 75 per cent. of the total heat of combustion, as compared with something like 15 to 20 per cent. in the case of illuminating gas. (5) The thermal equivalent of 1 candle-power-minute of magnesium light is about 2·4 lesser calories, as against 3·5 to 4 for other artificial illuminants. (6) The total efficiency of the magnesium light is about 10 per cent., as compared with 0·25 per cent. for illuminating gas. (7) Taking into consideration the greater average luminosity of the rays of the visible spectrum of the magnesium flame, it is certain that, per unit of energy expended, the light-giving power of burning magnesium is from fifty to sixty times greater than that of gas.

NORTH OF IRELAND ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Dublin.

The Annual Meeting of the above Association was held last Tuesday, in the Exhibition rooms of the Alliance Gas Company, Dublin, which had been kindly placed at the disposal of the members by the Directors of the Company. Mr. W. S. STORMONTH, of Coleraine, the Vice-President, occupied the chair. There was a good attendance of members.

ANNUAL REPORT.

The preliminary routine business having been disposed of,

The SECRETARY and TREASURER (Mr. J. Whimster, of Armagh) read the annual report of the Committee, as follows:—

The Committee, in presenting their annual report, regret to state that, owing to the heavy bereavement which our respected and venerable President sustained during the past year, he felt compelled to resign the duties of the office. The Committee, deeply sympathizing with Mr. M'Cullum in his affliction, fell back upon our energetic young Vice-President, who kindly stepped into the breach, and has undertaken to preside over our Dublin meeting.

The Committee are sorry to report the loss, through death, of one of our original members—Mr. Merrilees, of Castleblayney; and they also regret the removal to England of Mr. Featherstone, one of our most active members, and a Past-President.

The Committee believe that the Dublin meeting will be a specially interesting one, as, besides two papers on very important subjects, they have been able to secure, through the kind offices of Mr. Cotton, of the Alliance Gas Company, a lecture by Professor Tichborne, and a description and exhibition of his new "Intensity" burner at the Howth Lighthouse, by J. R. Wigham, Esq., J.P.; and the members will also have the privilege of inspecting the Alliance Gas-Works.

In common with the District Associations of England, your Committee agreed to leave over our interests before the Commission on Labour in the hands of the able representatives of The Gas Institute and the Institution of Gas Engineers—Messrs. W. A. Valon and G. C. Trewby.

There will be a few applications for admission to membership with us at the general meeting; and your Committee recommend, as an act of courtesy to Professor Tichborne, that you should unanimously elect him as an Honorary Member of the Association.

According to Rules 25 and 26, three members of the Committee retire now, and are ineligible for immediate re-election. The retiring members are Messrs. Outon, Martin, and Williamson.

(Signed) WM. S. STORMONTH, President.
JAS. WHIMSTER, Secretary.

Accompanying the report was the financial statement, which was also read by Mr. Whimster.

On the motion of Mr. P. J. SALMON (Galway), seconded by Mr. A. GIBB (Newry), the report and statement of accounts were adopted.

ADMISSION OF NEW MEMBERS.

On the motion of Mr. J. WHIMSTER, seconded by Mr. D. WILLIAMSON (Ballybay), the following new members were elected: Mr. Auchterlonie (Mullingar), Mr. Merrilees (Castleblaney), and Mr. E. R. Love (Dundalk). On the motion of Mr. A. GIBB, seconded by Mr. MACKENZIE, of Edinburgh, Mr. A. Cameron (Glasgow), and Mr. P. Hurll (Glasgow) were elected extraordinary members.

ELECTION OF OFFICE-BEARERS.

Mr. A. GIBB then moved, and Mr. W. WALKER (Hillsborough) seconded, that Mr. W. S. Stormonth, of Coleraine, be elected President, and Mr. C. B. Outon, of Inchicore, Vice-President for the ensuing year.

The motion was carried unanimously.

Mr. STORMONTH said he desired to thank the members for the compliment they had paid him in electing him to the presidency of the Association, and to assure them that he would endeavour to advance its interests in every way he could.

On the motion of Mr. E. GRANT (Athy), seconded by Mr. J. ROBB (Cinderford, Gloucestershire), Mr. A. Gibb, of Newry, Mr. J. Nisbett, of Portadown, and Mr. R. Ross, of Dungannon, were elected to fill the three vacancies on the Committee.

The PRESIDENT said the next thing was the election of the Secretary and Treasurer. They had had some experience of Mr. Whimster in these offices; and all must acknowledge that his work had been well done. He had great pleasure, therefore, in moving that Mr. Whimster be re-elected.

Mr. GIBB seconded the motion; and it was carried by acclamation.

PLACE OF MEETING FOR 1893.

The PRESIDENT said the next business was to decide upon the place of meeting for next year. He had great pleasure in giving all the members a cordial invitation to Coleraine, where he was sure they would enjoy themselves.

Mr. MACKENZIE then moved that Coleraine be the place of meeting in 1893.

Mr. E. STEARS (Lisburn) seconded the motion.

Mr. WILLIAMSON said he had no objection to Coleraine; but it was desirable that the Association should meet in a place where the greatest number of members would be able to attend—a place which could be reached in time for the meeting without having to leave home on the previous night. He would therefore suggest Portadown.

Mr. WHIMSTER pointed out that it was desirable that they should travel about as much as possible with their Association; and it had never been in Coleraine.

Mr. WILLIAMSON remarked that neither had they ever met in Portadown.

Mr. WHIMSTER: Our President is in Coleraine.

It was then resolved that next year's meeting should be held in Coleraine—the date to be fixed by the Committee

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—It is with mingled feelings of pleasure and regret that I preside over your deliberations to-day. I am pleased that the North of Ireland Association should already feel strong enough on its wings to migrate so far from the home of its birth, and, for the first time in its brief history, to open its session in the Metropolis of Ireland. At the same time, I must add that this feeling of pleasure is tempered by one of regret that Mr. M'Callum, of Omagh, whom we elected to the presidential chair last year, has been compelled, because of a severe family affliction, to relinquish office. I am sure I do no more than express the feeling of everyone present when I say that we deeply sympathize with Mr. M'Callum in the great and irreparable loss he has sustained.

The meeting in Dublin is appropriate in two senses—first, because this is the centenary of gas lighting; and secondly, because it shows to our Southern brethren that we are anxious to meet them in the best possible spirit. It is not for me to descant upon the advantages conferred on humanity by the important discovery of a then comparatively unknown Scotchman working out his destiny in the obscure village of Redruth; but this I may say, that gas has proved to be one of the greatest civilizing agents of the Christian era. Since its discovery and application, all other forms of artificial lighting have "paled their ineffectual fires." Now and again one comes across an ancient who recollects when the herd boy stood at the table with a lighted pine torch to enable the ploughmen and other servants of the farm to eat their supper. The cruzie lamp was contemporaneous with the pine torch. Candles and oil were luxuries which the rich alone could afford. Although candles and oil are still largely employed, they do not have the commercial value of gas. Indeed, but for the discovery of gas, the industries of this and other countries could not have reached their present magnitude. I need not quote figures with which you are all familiar to show the importance of the gas industry itself. But when one thinks that nearly a hundred millions of capital is employed in the United Kingdom, that about four hundred millions sterling are engaged throughout the world in providing artificial light, and that on this vast capital there is an average return of about 5 per cent., one begins to realize how much the world at large is indebted to the discovery made by Murdoch.

The other sense in which I said it was appropriate that the meeting should be held in Dublin this year has reference to the union of the Southern and Northern Gas Managers. The North of Ireland Association holds out the right hand of fellowship to its Southern brethren. That its title is the "North of Ireland Association of Gas Managers," should be no stumbling-block to those who have the welfare of the gas industry at heart. The poet asks: "What's in a name?" So ask I. If by a broader title a larger influx of members may be obtained, and if, by reason of our number, we are better able than at present to improve the process of gas manufacture in this island, and advance our common cause, then by all means change the name. When the Association was formed, invitations were sent north, south, east, and west, by our energetic Secretary, Mr. Whimster. The response was mainly from the north; and therefore the name of the Association as it at present stands. But we in the north are not prejudiced in favour of the title; and if a national association can be formed, I, for one, will do my best, no matter what name is given to it, to make it a success. These are the views which I personally entertain; and I give free expression to them.

Leaving these matters aside, I must now say a few words to you by way of introducing the papers to which we are about to listen. I confess to a feeling of bewilderment at the task which has been imposed upon me. When, week after week, I search the pages of our technical journals, and see recorded addresses so full of matter for deep thought, I feel my own inability to do anything which will bear investigation or criticism. I am, however, comforted by the consideration that I have to address gas managers who, as a rule, are not called upon to deal with abstract propositions, who have not to think of the strains on columns to support colossal gasholders, who have not to exercise their brains concerning the introduction of machinery for charging and drawing retorts, and who have not to determine whether they shall erect elaborate machinery to deal with sulphur compounds. These are all subjects which engineers of extensive works must necessarily study and work out. In this country, the majority of the works are of small dimensions, owing to the comparatively limited size of the towns; and the manager has often to perform duties which would astonish many of our English brethren. But though the works are small, it does not follow that the managers' duties are not onerous; nor does it follow that, by special and personal attention to details, the consumption of gas may not be materially increased. Before bringing these remarks to a close, I propose to show how the demand for gas may be extended, and an enhanced revenue obtained.

In Ireland, as well as in England and Scotland, the question of maintaining the illuminating power of gas has been exciting a good deal of attention. Hitherto we have depended on cannel for this purpose; but, as you are all aware, the price of this material has increased to such an extent that only two alternatives are open to us—either to reduce the illuminating power of gas or increase its price. Neither of these alternatives commends itself to the gas manager, because in either event he would have to face a good deal of irritating grumbling. At this juncture, when cannel is almost prohibitive in price, our old enemy oil comes forth in the part of a friend; at least, let us hope that it is so. It may be premature to say how far its friendship goes; but that is being put to the test in several of the larger gas-works in England and Scotland. Many papers have been submitted to the Institution and the Institute on this subject; and from these it appears that the saving by using oil as an enricher is not very great, except, indeed, where the gas made per year may be counted by hundreds of millions of cubic feet. Personally, I have no experience in the use of oil; but I gather, from the statements of those who have, that the difficulty of "cracking" up oil, and converting it into permanent gas, has been, or is being, overcome. I will not, however, assume the functions of the prophet, and predict how long the price of oil may continue as at present. An abnormal demand for it may have the same effect as it has had on the cannel market. In my own case, until three years ago I used English coal, with a mixture of first-class cannel, sufficient to enable me to produce 19-candle gas. This was quite satisfactory until the price of cannel went up to nearly double its former figure, and English coal increased in price from 4s. to 5s. per ton. I then determined to give Scotch caking coal a trial. Samples of these coals were obtained, and practical trials were made with them. The trials proved satisfactory; and as the price was suitable, this class of coal has been used ever since. I use no cannel whatever; and I find no difficulty in maintaining the standard at 19 candles. In my opinion, the choice of coal is of more importance to the Irish than to the majority of English and Scotch managers, because we get from 13s. to 20s. per ton for coke, and we have to pay the same heavy freight whether the coal is of a rich or a poor quality. We should therefore exercise great caution in selecting coal capable not only of producing good gas, but of yielding a large quantity of saleable coke.

With reference to the illuminating power of gas, I may say that, in a lecture delivered before the recent meeting of the members of The Gas Institute by a gentleman of eminence, it was stated that not one consumer in a thousand would notice a difference of two candles in the illuminating power of gas. With all due respect to the lecturer, I must say that my experience is entirely different; and I am sure I do not stand alone in this respect. If it be true that the ordinary consumer can detect no difference between (say) 16 and 18 candle gas, then managers in this country and elsewhere are accountable for an enormous waste of money in maintaining the higher standard. Here let me mention that I have a vivid recollection of raising the illuminating power of gas in Coleraine from 17 to 19 candles. This occurred some five years ago. No one knew that a change was to take place, save the Chairman of the Board and one or two other Commissioners. What was the result? Why, the second evening after the change had been made, the difference in the quality of the gas was observed and commented on all over the town; and it was so greatly appreciated, that the higher quality has been maintained ever since.

Although we realize such a handsome return from coke, we cannot say the same for some of the other bye-products—notably with respect to tar. True, in many of the smaller works the winter's make can be disposed of in the summer-time at from 2d. to 3d. per gallon; and in some places even a higher figure is obtained. Personally, I may say that I have a fair summer sale at an average price of 2½d. per gallon; but for several years I have been compelled to burn the surplus stock in winter. The nearest market to which I can send tar is Belfast; but all that can be got for it there, after paying carriage, is ¼d. per gallon. Now, rather than accept such a miserable return for tar, I burn it as fuel; and my experience tells me that as fuel it is worth 1½d. per gallon. The tar is run into the furnaces through an appliance which is home made. It is simple and inexpensive; and I shall be pleased to show it to any member who chooses to pay me a visit at Coleraine. This apparatus does not require a filter; no cock is necessary to regulate the flow; and steam can be dispensed with. Moreover, I can change from tar to coke, and from coke to tar, in a minute, if occasion demands it. The heat obtained by the use of tar is greater than that got from coke; and for this very reason, care must be exercised not to let the heats get too high.

With regard to the disposal of the liquor, Irish gas managers are placed at a disadvantage. In the majority of instances, the works are too far removed from chemical works to make the transmission of the liquor profitable; and then some works are so small that the erection of plant to work it up would not return a satisfactory revenue. The consequence is, that a great quantity of this valuable bye-product is allowed to run to waste. I have seen it urged elsewhere that, if companies were to combine and start a chemical works in some central position, and if these companies were to draw profits *pro rata*, the difficulty of working up ammoniacal liquor in country districts would be overcome. I do not know in how far such a scheme would prove applicable to Ireland; and I have not had time to regard the question from a geographical point of view. But it is worthy of consideration. I throw out the hint; and perhaps some member of this Association may prepare a paper on the subject for our next annual meeting. Before leaving this question, I may observe that the process of converting ammoniacal liquor into sulphate is exceedingly simple; the plant is inexpensive; and the profit is considerable. In my opinion, every works carbonizing 500 tons of coal and upwards per annum should work up its own liquor—providing, of course, that the liquor cannot otherwise be disposed of to advantage. As this question was discussed at the Belfast meeting last year, I need not dwell at any greater length upon it.

In my opening remarks, I incidentally referred to the matter of encouraging the demand for gas. This is a subject which, above all others, deserves and requires serious attention at the hands of every gas manager. Local circumstances must determine how this is best to be accomplished; but much depends on the way in which the gas manager sets about his business. Of course, in large towns, it is impossible for a manager to give personal attention to every detail; but with Irish managers, as a rule, the case is different. Now, I regard it as the bounden duty of every manager to constantly remind the public of the numerous benefits which may be derived from the use of gas, whether as a lighting, cooking, heating, or motive-power agent. When this Association met in Dundalk, I had the privilege of reading a paper in which I narrated my experiences in introducing gas-stoves in Coleraine, and the results arising from their introduction. Since then, the same policy has been continued; and we have held gas exhibitions and cookery classes at various times, with very satisfactory results. Some four years ago, there was only one gas-stove fixed in Coleraine; now there are over 300 of various kinds. In four years the private consumption of gas has increased nearly 40 per cent.; and at the end of this year, I expect to find the increase up to 50 per cent. That is to say, in five years there will have been an increase of 50 per cent.—an average of 10 per cent. per annum—which is chiefly attributable to the greater use of gas as fuel. This, I think, is a fair reward for the trouble taken to bring the merits of gas prominently under the notice of consumers. But this policy has another result, besides that of increasing the number of stoves fixed. It brings the manager into more intimate contact with the public; and I have instances where the introduction of a stove or a fire has been the means of introducing gas as a lighting agent—the stove has been the means of introducing the burner.

Every trader is liable to have complaints from his customers; and the trader in gas is no exception to the rule. When such complaints are received, I would advocate prompt, and sometimes personal, attention being given to them. Burners originally bad, and burners bad from age, are, I find, the chief causes of complaints about "bad gas." This being so, the true remedy appears to me to give and fix good burners free of charge. This we have done in Coleraine for some years; and we find ourselves amply repaid for the small cost involved by the greater satisfaction to our customers. A satisfied customer is always better than one who is continually grumbling; and satisfaction can be more easily assured by substituting good burners for bad, than by giving advice, which might be thought biassed, and which is more often ignored than acted upon. The use of good burners, and of regenerative lamps, should be encouraged in every possible way, so that the best value can be obtained from the gas consumed, and satisfaction thus given to both supplier and supplied. If no care is taken to see that our customers employ the best means to develop the full value of the gas we supply, and no regard is paid to the amount of the quarterly account, a mistake is made; for by neglecting these things, discontent is engendered, and discontent opens the door for our rivals.

I do not intend to express any opinion upon the relative merits of wet and dry gas-meters; but I will say that a consumer ought to have the kind of meter he desires. If this be refused, the consumer is sure to suspect some ulterior motive—that you are forcing upon him a meter for your own benefit; and future dealings with that consumer will be attended by discomfort to both sides. Still, I must say this, although opinions differ as to dry meters being a cure for "jumping lights" where pipes are improperly laid, my experience is that they are a certain cure. Six years ago, I replaced several wet meters by dry, for the very purpose of remedying this defect; and there has been no trouble since the change was made.

The labour question has within recent years assumed vast proportions in the public mind; but a careful survey of the position will, I think, disclose the fact that, though in some few cases there may have been grievances calling for redress, in the great majority the demands of labour have been quite unreasonable. Whenever labour troubles assail us, firmness and decision, applied at the proper moment, are often sufficient to put matters upon a proper basis. I am strongly in favour of paying liberal wages to good men; and I am firmly of opinion that none but good and capable men should be employed in the retort-house, for one inefficient stoker will spoil the whole number. The position of the stokers at Coleraine has been greatly improved within the last three years. The pay has been increased; a free Sunday is allowed every month during the six summer months; and a week's holiday per annum with full

pay is granted. When men do their work well, they should receive every possible encouragement; and without encouragement, to expect good work is to expect too much.

Electricity has made that progress during the year which still entitles it to be called the "light of the future." In special cases, the electric light may be found beneficial—for instance where a naked light would be a source of danger; although freedom from danger can be secured by the use of gas-lamps of the regenerative type, and at a far less cost. About two years ago, the proprietors of one of the saw-mills in Coleraine adopted the electric light, and by so doing obtained a reduction of £5 per annum in the fire insurance premium. The cost of installation was £50 for eight lights; but how much extra is paid for running the dynamo and upkeep of lamps, in order to save the £5 per annum, I cannot pretend to guess, and the owners are not at present able to give the figures. The yearly consumption of gas averaged about 3000 cubic feet; it would thus appear that the saving is questionable, and our loss not considerable. Another installation of 130 lamps was at work last winter in a portion of a linen factory—the spare power from the engine being utilized to drive the dynamo. The cost of fittings was upwards of £200. The saving in this case has not yet been ascertained; but I should state that the gas bill is not any smaller. The electric light was started in the streets of Larne last year, and I had hoped to be in a position to give you some particulars about it, but unfortunately I have been unable to obtain the necessary information in time for our meeting. I purpose, however, returning to the subject of electric lighting at some future time, when I hope to be able to lay some statistics before you.

In conclusion, I trust you will overlook any want of originality in these few necessarily hurried notes. I have endeavoured, to the best of my ability, to fill the gap which the regretted absence of our President has caused; and if I have in any respect fallen short of expectations, I can only crave your kind indulgence. But apart altogether from the formal business of our meetings, this gathering together has advantages which are beneficial, not only to ourselves, but to our employers. By thus meeting, we have an opportunity of interchanging experiences and ideas, and thus mutually helping each other, while, at the same time, advancing the great industry with which we are connected. We Irish gas managers are so far removed from each other that an annual conference cannot fail to produce both profit and pleasure to us all; and if we experience these to-day—as I sincerely trust we shall—one great object of the North of Ireland Gas Managers' Association will be attained.

A cordial vote of thanks was passed to Mr. Stormonth for his address, and briefly acknowledged.

Mr. P. J. Salmon (Galway) then read the following paper:—

THE NECESSITY OF A CONSULTING ENGINEER FOR SMALL WORKS.

As the managers of very small gas-works find the preparation of a paper a rather difficult task, especially when they are looking up a subject which has not been discussed by their own or some kindred Association, it is scarcely to be wondered at that there is a lack of these productions. When, however, a paper is to be discussed in a friendly spirit, there is no manager who cannot bring forward something that may be profitable to his employers, his colleagues, or himself personally. I therefore wish to offer a few remarks on the desirability of having a consulting engineer for small gas-works. My experience in the West of Ireland will clearly show the necessity of making some important change in the present system of carrying on small gas, and, I presume, water undertakings. As the salary offered by the owners of these works is seldom as high as that paid to respectable mechanics, it is not surprising that one frequently meets most incompetent persons in charge. But these very people make it a point to produce first-class testimonials from parties who know very little about the qualifications required to fit them for such a position. Having myself been rather unfortunate in succeeding a few of these people, I will, as briefly as possible, give a slight sketch of my experience.

In my first works, my predecessor was a lamplighter. The custodians of those works were, as they generally are, small shopkeepers, who do not always consume gas, owing to its expense, but, having a voice at the Board, endeavour to prevent the introduction of improvements, also on account of expense. These men are most attentive at the meetings; and they are generally very good judges of coal, lime, and other materials required for the works. The consequence is that the manager, however competent he may be, gets very little encouragement from people of this class. If coal gives them satisfaction in their houses, they cannot see why it should not be good for gas making; and then they always see it kept in an open yard. The coal is ordered from a local firm; and one can guarantee the manager a very pleasant time if he ventures to offer his opinion on, or raise an objection to, the article supplied. These men interfere in every possible way. Statements are made at their meetings of what they have read in the papers about the Manchester Gas-Works. Others, perhaps, have seen that something like sugar comes from coal tar. Then someone learns that indigo is very dear; and as he understands that this is "something they get from the gas-works," he wants to know how it is "we cannot get these things." The manager tries to explain; but he is met with the following: "Oh, that's all nonsense. A gas-works is a gas-works all the same." The auditor comes; but he can give no opinion. So the unfortunate manager is left to pass years of misery, as he is ashamed to meet experienced persons, owing to the dilapidated condition of his works. One would think he was asking a personal favour when requesting improvements to be made. In such a position as this was I placed for eleven years.

My next works had a make of 17 million cubic feet of gas per annum. The gentleman formerly in charge—a local merchant, and the contractor for lime, &c., to the Company—having died, the Directors considered it advisable to bring about a general change, and give the new man sole charge. Such was the condition of the Company that the owners contemplated closing the place. Had you seen their works four years ago, you would not wonder at their coming to this conclusion. Their output was (say) from 80,000 to 100,000 cubic feet per 24 hours. The yearly make, as I have said, was 17 million cubic feet; the loss or unaccounted-for gas being rather more than 4½ millions. The gasholder capacity was 35,000 cubic feet. There were three holders; but, owing to leaky tanks, their utility for storeage purposes was reduced considerably. They were patched in such a manner that one could hardly distinguish the original sheeting; and the bye-pass valves on the condensers were full open. There were on these works altogether 31 valves; and those on the purifiers had not been properly changed for 14 years. On the stock of meters being taken, £200 worth of them were carted away, and thrown in the river. The stock of brass-work and fixtures was less by £300 than was shown in the accounts. On making inquiries, I found that the largest sum ever received for coke was £230, or 230 tons of coke against 1800 tons of coal carbonized. The lime account varied from £60 to £75; and it was seldom sold after use in the purifiers. No gas could be made while the cleaning out of the purifiers was going on; and the necessity for this operation was judged by the length of time they had been in use. The gas supplied, when available for use by the consumers, was so bad that several cut it off. In fact, the Company lost something like half their customers, and were the means of opening a necessity for electric lighting, for which a company was started. However, as there was a determination to go on, on they went. New condensers and purifiers were put in, a new engine-house was erected, and the mains were overhauled. Consumers began to come back; and those who were wavering decided to remain with us. The electric light company displayed their light in public. As this was anticipated, a Bray lamp was erected by the Gas Company, which gave general satisfaction.

So far matters were satisfactory; but there seemed something wrong nearer home. Having had my hands full so far, I was unable to pay very much attention to other important matters. I now turned it to the coke and lime. Having reported to my directors my intention to check all sales of coke, I received next morning a letter bearing skull and crossbones, accompanied by a caution not to go further in this matter. If I did, to beware! Now, this convinced me that there was something wrong. I put on the check; and one of our old officials very soon left the service. As I have already said, the amount received for coke never exceeded £230 in the year. Now, with a check for only part of the year, it was £474. I received a second letter; and this time the coffin was displayed, with a caution to leave the town at once, or prepare for instant death. After checking for an entire year, I realized £604 by the coke; and last year the figure was £670—the coal carbonized being 1838 tons. The leakage has been reduced by 1,570,000 cubic feet. The lime, I discovered, was from three to four barrels short on each load.

In the meantime, the improvements have been pushed on by the erection of a telescopic and a single-lift holder. Another is in the hands of the contractor, and is expected to be in working order within three months. The auditor attends, and sees the accounts are correct; but while this is being done, there is no one to give an impartial opinion or report on the general condition of the works. In other words, while great attention is given to the accounts, hardly a thought is bestowed on the works. I have known directors to inquire, on seeing a new holder placed in an old tank, if there was ever a holder there before, although it had been in use for upwards of 35 years.

I am requested by my Directors, on receipt of a letter from an adjoining Company, to pay a visit to the works, and give my opinion on their condition. This Company had been, through their Secretary, doing business with our former Manager, Secretary, Contractor, &c. On my arrival, I found things in the same state as in the other works. The whole place was a total wreck—the holder down, the station meter out of order, the mains all leaking, about half the consumers' meters not registering, the Company in debt, the books all made away with—in fact, anything loose had been made away with. Yet the auditors had attended and looked into the accounts; but no thought was given to the inspection of the works. These works were closed.

You will naturally ask how my Company is at present situated. Well, having lost something like £800 in two years, they have almost rebuilt their works; and the last balance-sheet shows the concern to be in a most healthy condition, with something on the right side as a start for the bright future.

Mr. Salmon added that, since he had written the paper, an Electric Lighting Company had been lighting a portion of the docks at Galway, but not with very much success. On the 1st of the present month, the contract for lighting the town was advertised. The Electric Lighting Company did not put in an appearance; and the Gas Company received 35s. per lamp extra for lighting the town.

Discussion.

The PRESIDENT remarked that Mr. Salmon's paper was an excellent one, on which he should like to hear some criticism.

Mr. T. HANDS (Enniskillen) said the paper was somewhat conflicting. In the first place, Mr. Salmon's "manager" was not a manager at all, but only a lamplighter; so that it could not be expected that he would bring the works into a condition that would be satisfactory either to the public or to his directors. But the point he (Mr. Hands) wished to touch upon was as to the consulting engineer. If a man was not fit to take charge of a gas-works (say) with an output of 20 millions per annum, he had no business to go inside the gates; he was not only disgracing the works, but injuring the man who was to follow him. He did not see what a competent man wanted with a consulting engineer. He was speaking from experience; and he ventured to assert that a consulting engineer, instead of being a blessing to a gas-works, was only an injury. The man who was formerly in charge of the works in which he (Mr. Hands) was at present, had a consulting engineer. He said: "I am inside these four walls; they have a consulting engineer, and I cannot do anything without consulting him." He was put there as manager; and he had not a voice in any matter, whether good, bad, or indifferent. When he (Mr. Hands) went to Enniskillen, he found the place nearly as bad as Mr. Salmon's. The plant was just as it had been put down. Now, everyone knew there had been great revolutions in connection with the manufacture of gas since then. The man who could make gas then, if put into the works now, would not satisfy the public, who expected greater things at the present day than they did 45 years ago. Yet the plant he referred to was there just the same. He brought plans of the alterations necessary, and submitted them to the Manager; and the first thing he did was to write to the Chairman of the Company, suggesting that a Consulting Engineer should be employed. The make was 300 millions a year. The average they were in the habit of getting was 7100 cubic feet per ton of coal carbonized; and they thought they were doing well if they produced 8000 feet. He considered they were doing very badly. He (Mr. Hands) had the run of the plant; so he considered he was competent to take charge of the works. The Chairman of the Company said he knew him (Mr. Hands) personally; and he said "Let him go on." He had made up his mind that, if a Consulting Engineer came into the works, he would put on his hat and walk out. What was the use of a Consulting Engineer? He just came in, looked round, and gathered information. Where did he get it from? He had to depend upon what the men and the Manager told him. He formed his ideas, and put them before the Directors; and because he was a big man, they looked upon it as something great. No doubt it was, as regards money matters. Well, he (Mr. Hands) altered the plant, and now he could easily get 10,000 cubic feet of 16 or 17 candle gas per ton of coal. Added to that, during the past six months they had a saving of upwards of 80 tons of coal as compared with the corresponding period of 1891. So that if managers would study, and act on the self-confident principle, they would rise to the same competency as a consulting engineer, and really make themselves capable and independent men. He strongly opposed the proposition that gas-works should be put under a consulting engineer.

Mr. WHIMSTER said he should be rather inclined to take Mr. Salmon's part. He wished, however, that gentleman had dealt with the subject in a more complete and definite manner than he had done. He had given the members a number of facts from his own experience, but had left them to infer therefrom that he deemed a consulting engineer to be necessary in small gas-works. Mr. Salmon appeared to consider a consulting engineer to be quite as necessary as an auditor in a gas-works up to a fairly large size; and he (Mr. Whimster) was inclined to agree with him. Of course, if an auditor was necessary, however well qualified and experienced the secretary and treasurer of a gas company might be, why should not a consulting engineer be accepted, however well qualified the manager was? For, after all, what did directors of isolated gas-works really know as to what amount of return ought to be obtained in the way of residuals, or even what quantity of gas should be made from a given amount of coal? Some managers would not relish the idea of a consulting engineer being brought in; but if they were doing well, would it not establish them more fully in the confidence of their directors? Mr. Salmon's return for coke now looked exceedingly good; but he (Mr. Whimster) should like to know his return for residuals —*i.e.*, from coal—altogether. He generally looked more to this, as some managers might have a good market for coke, while with others it would be a drug in the market. In his own case, having a fair demand for coke, he sold what tar he could in summer at a good local price, and burnt it in the winter to save the coke. The result was that from coal costing 19s. per ton in the store, he obtained from residuals a return of 9s. 6d. to 10s. per ton; and it would be much more but for the wretched state of the chemical market. Certainly, in very small works, it was a "penny wise and pound foolish" policy to leave everything in the hands of a man who, however hard-working and straightforward he might be, manifestly had not received the necessary training to qualify him to conduct to proper advantage such a concern as a gas-works; otherwise he would not remain with them at the miserable pittance such companies usually offered. But to his mind the worst feature in a great many small gas-works he had seen (not in Ireland alone) was dirt; and if there was anything he detested it was to see a gas-works where one could not move about without coming in contact with tar. The employment of a consulting engineer would have the effect of keeping such places clean and tidy, as well as in proper repair; and this in itself would be a gain, even financially. Moreover, it would be a pleasure to go into the works, whereas at present it was a torture.

Mr. G. R. LOVE (Dundalk) said that he had listened with much interest to the remarks which had been made. He thought there were certain things about which they ought to be very careful. There was a great desire on the part of boards of directors and of commissioners to underrate the services of gas managers. He thought they ought to be very careful to maintain, as far as they could, the dignity of their fellow-managers; and he considered it would be a mistake to let it go forth from a body of gas managers that it was essential to have a consulting engineer. If there were such a person in connection with the Dundalk Gas-Works, he (Mr. Love) would feel that he was regarded as not fit for his post, and that all things would be referred to the engineer. If he wanted any extension, he must then go to him on the subject; and he considered that his own powers would not be taken into account by the Directors. There were a great many gas managers in Ireland who were capable men, but who never had an opportunity of showing their capabilities, because there were consulting engineers in connection with their works. Why not give these men a chance? Certainly, he must admit that there were a number of very incapable gas managers, and also many dirty works such as their Secretary had described. But sometimes where there were really capable managers, and even where there were consulting engineers, they still found dirty works. It did not always follow that where they had "A 1" gas-works, there was a consulting engineer. The manager was on the spot, and knew what was required for the works. He was there every day, and saw what would suit his place; and it did not follow that what was suitable for one works would be for another. He thought their best plan would be not to lay down any hard-and-fast line as to the employment of consulting engineers. It might be requisite in certain cases; but, in his opinion, what they ought to aim at was to do their utmost to raise the status of the gas manager. Let him make himself familiar with his works—see what he had done to-day, and make this the starting-point for what he was to do to-morrow.

Mr. J. ROBB (Cinderford) said he had had some experience —indeed, a great deal more than he had bargained for in many instances—of broken-down gas-works. He did not think Mr. Salmon's paper went far enough; and he altogether disagreed with him and Mr. Whimster as to the necessity for having a consulting engineer. A gas manager was one of his (Mr. Robb's) Directors; and he was very pleased to say that his Board, including the gas manager, had not felt inclined to interfere. It was a very difficult thing for gas committees and boards of directors to choose efficient managers. Men came with first-class testimonials, and directors relied upon them; and they had no one to guide them in their selection, unless they happened to have a consulting engineer. At the present time he did not admire the system of certificates granted by the City and Guilds of London Institute. He thought the District Associations of Gas Managers should endeavour to alter that. He considered that they themselves should examine the candidates for admission to their Associations. They had a splendid practical "Treatise" on their profession, which addressed itself to almost every detail and every point connected with the gas industry. Why could they not study these and other matters of detail, such as drawing, chemistry, &c., examine their own candidates, and issue certificates or diplomas themselves? What was there to prevent them from recommending managers to directors? There was another point he should like to mention. He found that in a great many works the person called the manager was really not the manager at all, but that the secretary was; and this gentleman was generally a contractor for coal and lime, and all such things. He thought they might in many cases take the offices of manager and secretary and treasurer, and unite them all into one. He held all these offices himself; and his Board were very well satisfied. He was of opinion that the real thing to be done was this: The Association ought to consider the question as to whether it would not be advisable for them to examine candidates for admission to membership, and recommend them to companies.

The PRESIDENT said their best thanks were due to Mr. Salmon for his paper. The author, as he understood, only recommended having a consulting engineer for such works as required to be put in order. Undoubtedly, the salary paid to the gas manager was in many cases not sufficient for a respectable mechanic; it was, in fact, utterly impossible to live upon it. There could be no doubt that Mr. Salmon had made an excellent job of the works he had in hand.

Mr. SALMON, in reply, said he was very pleased to find there was so little need of the services of a consulting engineer; but if the members were placed as he was, and had a managing director who was a butcher, he thought they would admit that, as a protection to the manager, there should be someone who could be consulted. In his case, the works had an output of only 6 million cubic feet; and there were leakages all over the town—in fact, out of the 6 millions there was a leakage of 2½ millions. If they had a gentleman to visit the place as a consulting engineer, the works would be put into better condition; and he maintained that this would be of great benefit. Of course, where it was not necessary, a consulting engineer was not likely to be introduced; but it was a great protection to a manager to have someone to stand between him and his employers. The difficulty was for the manager to convince them that he was competent to carry out the works.

Mr. J. ROBB (Cinderford) then read the following paper:—

SUDDEN EXCESSES OF SULPHUR IN CONNECTION WITH LIME PURIFICATION, AND THEIR REMEDY.

Some ten years ago, my attention was drawn in a very serious and disagreeable manner to the question of sudden increases of sulphur in gas. I was then starting out in life, and had only just settled down on my own responsibility, when one night, in the early part of the winter, when, as I thought, everything had been put straight for the day, I began to detect a strong putrid smell, which, after careful examination, I found to be emanating from the gas. This I could not understand, seeing that a clean purifier had been started in the afternoon. I at once had another purifier cleaned and put into use; but in a few hours the same trouble reappeared. The operation was gone through again, with a like result; but the next day things returned to their normal condition. I consequently came to the conclusion that either the lime had not been effectually slaked, or that the purifier had not been properly filled, because the lime had not the appearance of having been much used. However, I observed that, although white in appearance, it was hard and crystalline, even when pounded.

As I was not troubled again for some months, I dismissed the matter from my mind, as I thought I had discovered the cause of the mischief, and had resolved to keep a good look-out in future. In the following spring, the old trouble revisited me; and this time I concluded that it was neither the lime nor the filling of the purifiers that was at fault. (I may mention, however, that I succeeded in keeping the gas in the holders clean, although at some expense.) I decided to clean out all my pipes; and in looking through them, I found that the hydraulic main contained nothing but water—the tar being completely run off. A strong smell of ammonia and carbonic acid met me when I removed a large plug to examine it. I let the ammoniacal liquor run out, and replenished the hydraulic main with clean water. This effectually got rid of the nuisance; and whenever it appeared, the adoption of this remedy cured it at once. The following were my notes of observations at the time: "Troubled with sulphur in spring and autumn, and when liquor in hydraulic smelt strong."

About this time I was removed from Scotland to Ireland; and with this transfer my troubles in this direction ceased. I was free from them until I landed in England; and there I once more encountered my old enemy in almost unconquerable fury, which has cost me a great deal of anxiety. Luckily, however, I discovered the weak side of my enemy (at least to my own satisfaction); and I can assure you that I did not refrain from attacking him there. I may say here that sudden rises of sulphur in the gas in the Forest of Dean have not been uncommon, but rather the reverse; in fact, sulphur was a constant visitor, and latterly, to all appearance, had decided to take up its permanent abode there. I was not aware of this until I had been a few days in the district; but scarcely had I settled down when the unwelcome visitor called upon me. I emptied and filled, re-emptied and re-filled, my purifiers; but I regret to say the enemy conquered me in the long run, and my gas became foul. The incidents of my experiences of some seven years previously returned to my memory; and I at once examined the hydraulic main. But I found very little water there; the contents being mostly tar. This, then, was not the cause; and I knew my purifiers and lime were all right. I have a scrubber, but no washer; and water is pumped from the well over and over again, till its strength reaches 10° Twaddel. I examined the liquor, and found it very strong. I immediately bye-passed the gas—throwing the scrubber out of action; and then the nuisance began to abate almost instantaneously.

This led me to think, watch, and experiment a little; and the result thereof I will give you in a condensed form. When a sudden rise or fall took place in the temperature, my troubles began; and the stronger the liquor, the worse the complaint. The conclusions I arrived at were these: Water absorbs about 800 times its own bulk of ammonia at 50° Fahr.; but loses its affinity for it as the temperature increases or decreases, though scarcely in the same ratio when decreasing. Further, when water and ammonia are in combination, they absorb with avidity sulphuretted hydrogen and carbon dioxide; so that when the temperature suddenly rises or falls (as it often does in England), the ammonia is liberated, at once freeing the sulphuretted hydrogen and carbon dioxide—the latter having at the best only a slight attraction for ammonia. The whole of the three impurities go forward to the lime boxes. The ammonia is absorbed in the lime without any liberation; but it is different with the carbon dioxide. On entering the lime, it displaces the sulphuretted hydrogen, which, along with that coming from the scrubber, travels on to the other boxes, rapidly fouling them until it is exhausted. By working on these lines, and throwing my scrubber out of action when a sudden rise or fall in temperature takes place, I have succeeded in keeping myself for nearly three years free from any trouble arising from sudden excesses of sulphur in my gas. I have never found any harm arise from the liquor when it was weak. When, however, its temperature was below 40° Fahr., it reduced the illuminating power of the gas. This is a difficulty which could, of course, be easily overcome.

I would urge you all to see that your purifiers are of ample capacity. The usual space allowed is 1 superficial yard of grid surface, 4 inches deep, for every 1000 cubic feet of gas made per 24 hours. In my case it was somewhat below this, although it ought to have been very much above it (which I am glad to say it now is), owing to my coal coming direct from the mine to be carbonized. It consequently contains rather more than the usual quantities of impurities, and is very damp; the result being that a large proportion of the sulphur, which would be retained in the coke if the coal were dry, is carried forward in the gas when the coal is wet.

There are three incidents I should like to mention before closing my paper. First, I found the lime in different conditions—sometimes very much spent, at others in a medium state, and at others only tinted yellow. The second incident is this: I once had some lime that came in slaked, and when it was put into the purifiers it would not act for more than an hour at a time. When I looked at it, I found it to be hard, like salt. I inquired into the supplier's method of burning the lime, and found that he had three kilns, side by side. He lighted them one after another, allowing them to cool down in the same fashion. The lime became slaked, and formed hydrate. The kilns were all cracked. The carbon dioxide found its way through these cracks from the working to the extinguished kiln, and destroyed the lime—at least, as far as its value for gas purification purposes was concerned. The third incident is this: Last January one of my Directors came to me and stated that the gas was giving off a very bad odour. While he was telling me this, we were standing in a room where a number of gas heating and other appliances were being shown in action; and, strange to say, not the slightest smell was perceptible from them. I lost no time in investigating this; and I found that in only one part of the town was the bad odour noticeable. I then made my way to the works, to discover, if I could, what was wrong. A clean purifier had been put on in the course of the previous day, and everything was right at that time. When I reached the works, I insisted that someone must have interfered with the purifiers; but I was satisfactorily assured to the contrary. I tested the gas in the holders and the purifiers; but nothing was found wrong. By this time an hour and a half had elapsed; so I went back into the town to resume my duties at the exhibition—making inquiry on my way as to the smell complained of. To my surprise and joy, I found it had gone. This has been a puzzle to me ever since; and I fear it will remain so.

In conclusion, I may say I have refrained, as far as possible, from going into details, and have made my paper as broad and practical as I could. My reasons for avoiding details are two: First, I am not fortunate enough to be possessed of that priceless blessing an experimental laboratory, although I hope to have one at some future time; secondly, to base my calculations upon already known data would be of no use to you, as you are all qualified to do this for yourselves at your leisure.

Discussion.

Mr. WHIMSTER said he thought the members were very much indebted to Mr. Robb for his really practical paper. Mr. Robb's "old enemy" had been a source of annoyance to most gas managers in their time; and when it had attacked them, they had fought with it, and conquered it—sometimes scarcely knowing how. He had not been troubled with it for something like four years. He attributed the nuisance to various causes, and took steps to prevent a recurrence; and he thought he had solved the difficulty. The principal cause he imagined to be imperfect or else over-condensation; consequently he had closely watched the temperature of his gas at the outlet of the condensers, and either bye-passed them, or used them as the temperature fell or rose from 70° Fahr. He found the need of regulating in this way more necessary owing to the construction of his retort-house. From one set of benches he had a good stretch of foul main inside the house—two other sets of benches being comparatively near the condensers; and according to which set was at work, he required more or less condensing power outside. But perhaps Mr. Robb had found out the true secret; and his (Mr. Whimster's) attention to the temperature might have prevented the trouble arising in the scrubber. At all events, the paper would lead him to try the effect of changing the scrubber, should he ever have the misfortune to be attacked again.

Mr. HANDS said if they so arranged their hydraulic mains, and their condensers and scrubbers that there was a fall in one

direction only, and the syphons were so arranged that they would keep the apparatus clear, it would help to overcome the difficulties that they would otherwise have to contend with, as mentioned in the paper. The lime he used for the half year ending Dec., 1890, cost £36; and for the corresponding period ending last Dec., it was only £14 7s. 6d. He arranged for the foul main to be as much under cover as he could, keeping it as warm as possible.

Mr. GEORGE R. LOVE (Dundalk) said he had had no difficulty and no experience of sudden increases of sulphur. The use of oxide of iron in the purifiers would check entirely any increase in the sulphur impurities. He would also advocate the use of purifiers of large area, and the taking of the gas down through the lime or oxide, instead of up. By this means, there would be a larger and easier passage for the gas, and this would obviate the hard caking of the lime of which Mr. Robb complained even when using fresh lime. One other point he would wish to mention. He would have the liquor at the inlet or bottom of the scrubber of say 2° or 3° Twaddel; and by this means the work of the purifier would be greatly reduced by the liquor taking up the impurities.

Mr. A. GIBB (Newry) thought a good deal of the difficulty might be overcome if the lime in the boxes was not put in so dry as was frequently the case. He found that, if the lime was put in too dry, the purifier would not last so long. He had been frequently troubled in this respect; and to obviate it, he had the lime prepared—he had it strained, and as it lay in the purifier a large quantity of water was found on it. By this means he was seldom troubled with sulphur. He thought if managers would pay a little more attention to the dampness of the lime in their purifiers, they would not have this trouble to complain of.

Mr. SALMON considered it was a good thing to do to thoroughly wet the lime. The cost of the lime in the works he was connected with was formerly £60 to £70 a year; and now it was down to £30. He attributed this to the wetting of the lime. The workmen were, of course, very wishful to get it in dry, because it involved so much less labour.

The PRESIDENT said he did not envy Mr. Robb his experiences. He (the President) had been fortunate enough to escape such troubles as he had told of. It seemed to him desirable to ask Mr. Robb if any change was made in the coal. He could not agree with Mr. Gibb and Mr. Salmon that the wetter the lime was put in the purifier the better.

Mr. JOHN COOKER (Cinderford), having been asked by the President to address the meeting, said he could testify to the fact that there had been very considerable drawbacks as regarded the gas-works in his town previous to the advent of Mr. Robb. He (Mr. Cooker) looked at the matter of gas making from a consumer's point of view. He did not think the electric light was likely to come into country places for some time yet. In the meantime therefore every improvement in gas supply was an advantage to the consumer; and the better the gas was made, the more of it was likely to be consumed.

Mr. ROBB, in reply, said with reference to Mr. Whimster's observations, he thought both of them had been working very much on the same lines. He found that it was when the ammoniacal liquor came up to 10° Twaddel, and afterwards, that the mischief took place. With reference to what Mr. Hands had said, that was possibly the same, in effect—that was, in reference to the water in the hydraulic main. It was when the liquor attained a certain strength that he commenced to experience trouble. He had thought that, if he tried oxide of iron it would get rid of the mischief; but such a remedy would be expensive. He was, however, able to use sulphate of iron, as there were tin-works in the neighbourhood, and they were able to get sulphate of iron very cheap. With reference to the working of his purifiers, he allowed the current of gas to descend and ascend in alternate streams; so that there was complete action on the lime in every way. With regard to Mr. Gibb's and Mr. Salmon's remarks, he must say that their experience was altogether different from his. But he quite agreed with Mr. Stormonth that the lime, when it was thoroughly wet, and allowed to lie over for about a month, would absorb a certain quantity of water; and when he used it in this fashion, his sulphur was brought down to something like 20 per cent.

Professor TICHBORNE, having been invited by the President to address the meeting, said he understood the gist of the paper, (which he had not heard read) was that, on a rise of temperature, an objectionable evolution of sulphur took place, and that was chiefly in connection with the scrubbers. He merely rose now to mention an experiment which was very peculiar, and which he thought bore on one point in Mr. Robb's paper. It was that, if they took carbonate of ammonia—that which they all knew as the carbonate of ammonia of the shops, and which was what constituted the pungent smelling salts that ladies were so fond of using—and placed it in a vessel, and put that in a strong freezing mixture (say) 10° below freezing point, the carbonate became odourless. It became a permanent salt like sulphate of ammonia. The ammonia seemed to be fixed in it; but it was not permanently fixed. Mr. Robb made the complaint that his trouble came on with a rise of temperature—in other words, when the carbonate of ammonia and the carbon had become dissociated.

BYE-PRODUCTS.

Professor C. R. C. TICHBORNE then delivered a lecture, "On the Value of Bye-Products in Gas-Works, and an Improved Method of Estimating the Same." He said that one of his reasons for changing the title of his lecture was that when he was first asked to take part in the proceedings, he felt greatly complimented; but he thought it would be very difficult to talk to a body of men on a subject with which they were very much better acquainted than he was himself. He therefore thought of taking up the subject named, in dealing with which they stood on common ground—one on which he could give them the outcome of practical experience, and one which would, he thought, be very interesting to them in their vocation.

Professor Tichborne then proceeded to deliver his lecture, which we shall report in due course. At its close,

Mr. SALMON moved a hearty vote of thanks to Professor Tichborne for his interesting lecture.

Mr. C. B. OUTON seconded the motion. He remarked that the delicacy of the experiments performed challenged their most respectful attention and admiration. It ought to give an impulse to them in the further study of chemical science.

Mr. HANDS, in supporting the vote, said he was thinking, while Professor Tichborne was speaking, what a great blessing it would be if, instead of consulting engineers, they had consulting chemists on gas-works, and by this means brought the bye-products into greater service than at present. They lost sight of many of them altogether; and those who did not lose sight of them could not use them to the best advantage, because in many places the things were out of the market altogether. If they would only bring them more to the front, and get these products introduced to the public, the result he believed would be different.

The PRESIDENT put the motion as follows, and it was carried by acclamation: "That a cordial vote of thanks be passed to Professor Tichborne for his paper, and that he be elected an Honorary Member of this Association."

Professor TICHBORNE said he felt very much obliged to them for the complimentary way in which they had received his lecture. When he undertook to address them on a subject that he did not know much about, he thought it was a sort of inspiration that led him to take up the dual phase of the matter he had discussed. He thought, when they had the tables and figures in print, they would be of great use to them.

On the motion of Mr. GIBB, seconded by Mr. MACKENZIE, a vote of thanks was passed by acclamation to the President and Secretary, and to the readers of the several papers.

The proceedings then terminated, and the members afterwards dined together at Jury's Hotel, and subsequently a large party was formed for the purpose of visiting Howth Bailey Lighthouse.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Annual Meeting of this Association, which opened in Edinburgh on the 3rd inst., under the presidency of Sir ARCHIBALD GEIKIE, will not be conspicuous for the production of any striking novelty in connection with the gas industry. The proceedings in the Chemical Section (the President of which was Professor H. M'Leod, F.R.S., F.C.S.) on the following Friday were, however, of interest to the readers of the JOURNAL, inasmuch as they included three papers on subjects which have lately been brought rather prominently under their notice.

The first paper was the joint production of Mr. B. Lean, B.A., B.Sc., Dalton Chemical Scholar of Owens College, Manchester, and Mr. W. A. Bone, B.Sc., fellow of Victoria University, Manchester; the second was by Mr. Vivian B. Lewes, F.I.C., F.C.S., Professor of Chemistry at the Royal Naval College, Greenwich; and the third was by Professor Smithells, of the Yorkshire College, Leeds.

Messrs. Lean and Bone's paper was as follows:—

THE EXPLOSION OF ETHYLENE WITH LESS THAN ITS OWN VOLUME OF OXYGEN.

Our investigations arose out of experiments to determine the rate of explosion of hydrocarbons with defect of oxygen, and were made at the suggestion of Professor Harold B. Dixon.

We found that, on exploding ethylene with less than its own volume of oxygen, there was invariably a considerable increase in pressure. In case of a mixture of 100 volumes of ethylene to 96·5 volumes of oxygen, the pressure increased from 756 to 1503 mm. of mercury; indicating that the oxygen had mainly gone to the carbon and not to the hydrogen. On carefully analyzing the products of explosion, we found that, in addition to hydrogen, carbon monoxide, and small percentages of carbonic acid and unsaturated hydrocarbons, there was always present a small amount of some saturated hydrocarbon, presumably marsh gas.

We made and fired five different mixtures of ethylene and oxygen, containing 100 volumes of ethylene to from 70 to 96·5 volumes of oxygen. We invariably found both saturated and unsaturated hydrocarbons present in the products of the explosion; and the percentages of both these increased as the percentage of oxygen in the original mixture decreased, as one would naturally expect. The quantity of marsh gas present in the products of the explosion of 100 volumes of ethylene to

70 volumes of oxygen was 5·53 per cent.; and, in the case of the mixture containing 100 volumes of ethylene to 96·5 volumes of oxygen, we found 1·01 per cent. of marsh gas in the products.

With regard to the unsaturated hydrocarbons present in the products, a qualitative examination revealed the presence of acetylene. Whether this constitutes the whole of the unsaturated hydrocarbons present, we are not prepared to say it is certainly present in not inconsiderable quantities.

We may be allowed to add a note as to the nature of the reaction when ethylene is exploded with less than its own volume of oxygen.

The first reaction which doubtless occurs is a combination between the oxygen and part of the ethylene, with the formation of carbon-monoxide and hydrogen, according to the equation—

$$C_2H_4 + O_2 = 2\,CO + 2H_2 \qquad (1)$$

The heat liberated by this reaction produces a decomposition of some of the unburnt ethylene analagous to the decomposition which ethylene undergoes when passed through a red-hot tube into marsh gas and carbon, according to the equation—

$$C_2H_4 = CH_4 + C \qquad (2)$$

Marsh gas might also be produced in another way, by partial oxidation and decomposition, according to the equation—

$$2C_2H_4 + O_2 = 2CH_4 + 2CO \qquad (3)$$

The first reaction, however, is the more likely.

With regard to the formation of acetylene, this is most probably due to a secondary reaction between the nascent hydrogen formed according to equation (1), and the deposited carbon according to equation (2)—

$$2C + H_2 = C_2H_2 \qquad (4)$$

Our investigations have an important bearing upon the question of the luminosity of hydrocarbon flames. The view that the separated carbon, which doubtless is a cause of luminosity, due to the fact that oxygen combines with hydrogen in preference to carbon, is no longer tenable. Our work shows that oxygen combines with the carbon in preference to the hydrogen; and the separated carbon is probably due to the decomposition of the heavy hydrocarbons into marsh gas and carbons at high temperatures.

In conclusion, we beg to thank Professor Dixon for many valuable suggestions and kindly oversight of our work.

In the discussion on this paper, Professor Lewes said that although there was no doubt that carbon-monoxide and hydrogen resulted from the explosion of ethylene with insufficient oxygen, the same result observed by the authors might be obtained by the interaction of oxygen with part of the ethylene to form water vapour and carbon-monoxide, and then the action of the water vapour on the remaining ethylene, thus—

$$2(C_2H_4) + 2O_2 = 2CO + 2H_2O + C_2H_4 = 4CO + 4H_2$$

The second equation quoted by the authors was undoubtedly wrong, although given in every text-book, as if ethylene were heated to a temperature at which it broke up into marsh gas and carbon, hydrogen was always liberated; the true reaction being—

$$3(C_2H_4) = 2CH_4 + 4C + 2H_2$$

while the acetylene noticed after explosion was due to the action of the heat of explosion upon some of the ethylene, and not, as the authors supposed, to the action of the hydrogen and carbon.

The paper read by Professor Lewes was as follows:—

NOTES ON THE LUMINOSITY OF HYDROCARBON FLAMES.

Ever since Sir Humphry Davy, in 1817, advanced his celebrated theory as to the causes of luminosity of certain flames, the subject has commanded a great amount of attention; and the researches of Berzelius, Waldie, Volger, Hilgard, Landolt, Frankland, Stein, Heumann, Kersten, and more recently those of Soret, Birch, Stokes, and Smithells, have all added to our knowledge of the subject. Even now, however, many points remain to be cleared up before we can gain a clear conception of the numerous factors and interactions which go to make up a luminous flame; and it is in the hope of raising a discussion upon some of these points, that I venture to bring this paper before you.

Certainly the two most important landmarks in the history of luminous flames are the original enunciation of the solid-particle theory by Davy, and Frankland's celebrated attack upon that theory in 1868. The relative values of the views of these two great experimentalists have been so recently discussed, that it would be useless to again go through the mass of evidence which has accumulated during the past 25 years, and which seems to point conclusively to the luminous flames of burning hydrocarbons owing their power of emitting light to the presence of incandescent particles of practically pure carbon; while, on the other hand, I believe I am correct in saying that Dr. Frankland is unshaken in his belief that the cause of luminosity is to be found, not in the solid particles of carbon, but in the incandescence of heavy hydrocarbon vapours.

In a paper read before the Chemical Society in January last,* I described experiments and analyses which showed that the main reaction leading to luminosity in a flame containing hydrocarbons was the conversion, in the inner non-luminous zone, of these bodies into acetylene—a change brought about by the baking action of the heat evolved by combustion in the outer layer of the flame, and in no way dependent upon oxidation; the change being entirely brought about by heat, as can be shown by passing through heated tubes the various gaseous hydrocarbons present in illuminating gases.

If an ordinary flat flame be taken, and the gases carefully withdrawn from the non-luminous zone and analyzed, the ratio of the acetylene formed to the other unsaturated hydrocarbons will be found to rapidly increase in their passage up the centre of the flame:—

Acetylene formed in the Inner Zone of a Flat Flame from a No. 7 Bray Burner.

Portion of Flame.	Total Unsaturated Hydrocarbon. Per Cent.	Acetylene. Per Cent.	Other Unsaturated Hydrocarbons. Per Cent.
½ inch from top of burner	3·565	0·115	3·450
1½ inches from burner	2·063	1·303	0·760
1¾ " "	1·393	1·133	0·260
2¼ " "	trace	trace	—

These figures show that, by the time the top of the non-luminous portion of the flame is reached, upwards of 81 per cent. of the hydrocarbons present are converted into acetylene.

In such a flame, luminosity commences just above the inch and three quarters from the burner; and if luminosity is caused by acetylene, it is natural to ask why should it not have commenced at an inch and a quarter—a spot where the acetylene is present in larger quantity that at the higher point. The reason for this is that, in order to cause luminosity, a temperature must be obtained at which the acetylene is dissociated; and the point at which this takes place marks the commencement of luminosity. If this temperature is not attained, then the acetylene in the presence of oxygen burns away with a non-luminous flame, or if no oxygen is present, polymerizes into a number of higher hydrocarbons. If, on the other hand, a sufficiently high temperature is reached to cause dissociation, the liberated carbon becomes incandescent—chiefly from its own combustion, but partly also from the combustion of the hydrogen liberated simultaneously—and luminosity is the result. The temperature needed to cause the dissociation of acetylene varies with the amount of dilution—the more diluted it is, the higher being the temperature necessary to break it up; whilst the larger the quantity of acetylene, the lower the temperature needed to cause its dissociation, and the smaller therefore the inner non-luminous zone of the flame.

In the flame from ordinary coal gas, there is only from 1·1 to 1·3 per cent. of acetylene found in the inner zone; and in this highly diluted condition, it requires a temperature of close upon 1200°C. to break it up; whilst in other flames, richer in hydrocarbons, and therefore richer in acetylene in the inner zone, the temperature required is not so high. For example:—

	Flame of Coal Gas.	Flame of Paraffin Lamp.
Percentage of acetylene	1·133	2·222
Temp. at commencement of luminous zone	1267°	1062°

The fact that, unless the requisite temperature is reached, the acetylene burns away with non-luminous combustion, is, I think, clearly shown by the following experiment. The flame of burning alcohol contains more than half the quantity of acetylene that a good gas-flame contains, and yet the combustion is practically non-luminous. If a dish containing some alcohol be placed under a bell jar, it burns with a flame having slightly luminous edges, and the temperature of the flame in this condition is 1220° C. If now a glass plate be put over the mouth of the bell jar for a few moments, the mixing of the products of combustion with the air lowers the rate of combustion, and the temperature of the flame falls to 1050° C.—the flame becoming perfectly non-luminous; whilst if oxygen be admitted to the bell jar, the combustion is increased, and the temperature rapidly rises to 1510° C.—the flame becoming nearly as luminous as a coal-gas flame, and depositing carbon on any cold surface held in it. Again, if a small luminous gas-flame be allowed to play upon the bottom of a platinum dish, so much heat is abstracted from the flame that the temperature falls below the point necessary to break up the acetylene, and the flame becomes non-luminous; whilst if the flame is allowed to remain in contact with the metal until the dish is red-hot, the luminosity returns. The same effect may be produced by heating the interior of the dish with a blow-pipe flame. (This experiment was, I believe, devised by Heumann, to show the effect of cooling on luminosity.)

In every flame that I have examined which owes its luminosity to the presence of hydrocarbons, these bodies are converted into acetylene before luminosity commences in the flame; and every gaseous hydrocarbon which can by heat be made to deposit carbon, is converted into acetylene before any deposition takes place. Many of the hydrocarbons present in coal gas are known to give out heat during their decomposition; but probably the most endothermic of these compounds is the acetylene—Thomsen having shown that no less than 55,010 units of heat are absorbed in the formation of 26 grains of acetylene, whilst only 10,880 disappear in the production of 28 grains of ethylene. It is this which renders its decomposition by heat, or, as shown by Berthelot, even by detonation into carbon and hydrogen so easy. The fact that acetylene is formed from the gaseous

* See JOURNAL, Vol LIX., p. 795.

hydrocarbons present in illuminating gas prior to the emission of light does not, however, by itself, in any way disprove Dr. Frankland's theory that luminosity is due to very heavy hydrocarbon vapours, and not to solid particles of carbon; as the well-known tendency of the acetylene to polymerize into higher bodies might be taken as an explanation of the presence of sufficiently dense hydrocarbons in a flame given by (say) pure ethylene.

In order to determine whether or no the acetylene formed in the earlier stages of the flame renders the flame luminous, by liberating carbon during dissociation as required by Davy's theory, or by forming heavier hydrocarbons, a long series of experiments were made to ascertain the effect of heat upon the hydrocarbons present in coal gas, and by specially-devised apparatus to measure the actual temperature to which the gases were being heated, and to collect and analyze the resulting products. These experiments are still proceeding; but I may state the main results of them.

Ethylene passed at the rate of 4 to 5 c.c. per minute through a tube, 2 m.m. in internal diameter, undergoes no apparent change until the temperature rises to between 800° and 900°C. It then breaks down to methane and acetylene; and, simultaneously with the formation of acetylene, heavy vapours appear, which can be condensed, and in which benzene and naphthalene are conspicuous, as well as a heavy and highly fluorescent oil of high boiling point. Berthelot found that these substances were formed when acetylene was heated for some time at the temperature at which glass softens. He also recognized among the products cinnamene $C_8 H_8$, and retene $C_{18} H_{18}$; so that there seems very little doubt but that, in passing the ethylene through a heated space in which the temperature does not rise above 900° C., methane and acetylene are first formed, and the latter at once polymerizes into the heavier hydrocarbons. The amount of acetylene found in the products of the experiment at this temperature rarely exceeds 1 per cent., as the polymerization occurs almost simultaneously with its formation; but the proportion of ethylene decomposed and the amount of methane found in the products of decomposition, point to the initial action of heat at this temperature being $3\,C_2H_4 = 2\,(C_2H_2) + 2\,(CH_4)$. On increasing the temperature from 900° C. slowly up to 1000° C., the same action continues; no hydrogen appears in the products of decomposition, and no carbon is deposited, but the formation of oil and solid hydrocarbons is more abundant. Between 1000° and 1100° C., a trace of hydrogen appears, and a little carbon begins to deposit with the oil; this increasing with rise in temperature up to between 1300° and 1400° C., by which time all formation of oil has ceased. Carbon is deposited in larger quantities; and the residual gas consists of hydrogen with a little methane. The temperature at which oil disappears is about 1200° C.; and the proportion of acetylene formed at this temperature is larger than at any of the lower ones. It is evident, therefore, that, if the temperature existing in the luminous portion of the flame exceeds 1200° C., the luminosity cannot be due to such hydrocarbons as are formed from the acetylene, but that carbon will be present in abundance. I have made several analyses of the carbon so deposited, and find that the hydrogen in it varies from 1 to 3 per cent.; and as there is no fixed ratio, I think there is not the slightest foundation for imagining that it is in combination—indeed, Stein's work upon this point is fairly conclusive, and anyone who has attempted to prepare hydrogen-free carbon from sugar or other similar body, will realize the intense power which freshly liberated carbon has of occluding and holding hydrogen.

Ethane, which is present in illuminating gas in larger proportions than is generally supposed, breaks up even below 800° C. into ethylene and hydrogen, $C_2H_6 = C_2H_4 + H_2$; and the ethylene behaves as before on increase of temperature. Methane, which is not only present in very large quantities in the original gas, but is also produced during the decomposition of the ethylene, is apparently unaffected by heat until a temperature of 1000° C. is reached, when hydrogen and unsaturated hydrocarbons begin to appear in small traces—acetylene being the chief of these. This action continues and increases, so that, at about 1500° C., considerable quantities of acetylene are formed, which at once break down to hydrogen and carbon. With methane, as with ethylene, the first trace of acetylene found in the products is also accompanied by the formation of oils and heavy condensable vapours. Methane is not so easily converted into acetylene as the other hydrocarbons, and requires a higher temperature to bring about the change; but the fact that it does do so at high temperatures fully explains the facts first observed by Dr. Percy Frankland and Mr. Lewis Thompson, that, although methane when burnt by itself has but a very feeble power of illumination, yet, when used as a diluent of heavier hydrocarbons, it greatly increases the light-emitting power of the flame.

In order to apply the knowledge these experiments give of the changes taking place in the hydrocarbons present in coal gas during their flow through the heated channel in the interior of the flame, it is necessary to map out the temperatures existing in a luminous flame; and the flat flame from a Bray burner (No. 7) lends itself conveniently to this purpose. Using the Le Chatelier thermo couple described by Dr. Roberts-Austen at the last meeting of the British Association, and making only one short twist of the wires to give contact, and then coating them with hard glass, it is possible for nearly a minute to get the temperature in the portion of the flame in which the short twist is plunged; and if thin wires are used, the loss by conduction is very small. Of course, if the part of the flame through which the glass-coated wires pass is at a higher temperature than the portion around the twist, as the heat penetrates the glass, it will give too high a reading; but for the first 30 or 40 seconds, there is no fear of this. With this arrangement, I was able to map out the temperatures existing in the flat flame in which I had traced out the changes taking place in the constituents of the gas. I found that the temperature very rapidly rose from 500° C. ½ inch above the burner, to a little over 1200° C. at the commencement of the luminous zone—the luminous edges having a temperature of 1216° C.; and these temperatures were further increased in the luminous zone, until near the top of the flame 1368° C. was reached. This at once gives us the secret of the luminosity. From the mouth of the jet and up to a temperature of 1000° to 1200° C., we have the formation of acetylene from the original hydrocarbons; but the moment the requisite temperature is reached by the combustion of the hydrogen, the methane, and the carbon monoxide, the acetylene decomposes, with a further rise of temperature, and the carbon heated to incandescence radiates the heat and light.

In the experiments with the hydrocarbons, the gases were passing through a heated space 6 inches long, kept at a constant temperature; in the flame, they are passing through a space 1·75 inches long, with a rapidly increasing temperature, so that, instead of the acetylene becoming polymerized to any great extent, it reaches a temperature at which dissociation takes place almost immediately it is formed. Experiments with hydrogen-borne benzene vapour show that, at a temperature of 1200° to 1300°C., it is reconverted to acetylene; and this then at once breaks down to carbon and hydrogen. The same happens with all the other heavy vapours formed in the inner zone; and these bodies, formed probably in minute quantities by polymerization, together with any remaining methane, are reconverted into acetylene and deposit their carbon as soon as the necessary temperature is reached. This supplies a fresh quantity of carbon particles to the upper portion of the luminous zone, and so increases its size.

The careful analyses of Hilgard, Landolt, and Blochmann, made to determine the interactions taking place in various flames, are in their main features in close accord with a long series of analyses of the flame gases which I have made; and one of the most striking features of these is the comparatively slow rate at which the heavy hydrocarbons disappear as compared with the other constituents of the original gas. This I find to be chiefly due to diffusion, which causes the hydrogen and methane to find their way to the outer skin of the flame first; and it is these bodies, therefore, which bear the brunt of the earlier combustion, and yield the heat which bakes the heavy hydrocarbons ascending straight upwards from the burner into acetylene. If three concentric tubes be placed ½ inch above an open tube from which coal gas is issuing, and the gas from each is withdrawn and analyzed, it will be found that, on comparing them with the original gas, the action is most marked—the gas in the outer tube being practically a mixture of air and hydrogen and methane, and no heavy hydrocarbons; whilst in the inner tube, the unsaturated hydrocarbons have risen from 3·56 to 4·53. All analyses of the flame gases also show that the hydrogen burns first, and that next in rapidity of burning is the methane; and Professor Smithells advances the theory that, in the incomplete combustion taking place in the flame, the hydrocarbons burn to carbon monoxide and hydrogen.

As has been already shown, the proportion of heavy hydrocarbons consumed before conversion into acetylene and then dissociation into carbon and hydrogen, is very small; and the principal hydrocarbon undergoing combustion in the flame is methane. The analyses of Landolt Hildgard, Blochmann, Smithells, and myself, all show that a large increase in the carbon monoxide does undoubtedly take place the higher one ascends in the flame until the luminous portion is reached. It is also probable, from the same analyses, that hydrogen is generated by some action in the outer layer of combustion, as in spite of its rapid combustion at the base of the flame, as shown by the large percentage of water vapour formed there, it keeps reappearing for some little distance up the flame; and it is to explain the joint appearance of carbon monoxide and hydrogen, that Professor Smithells brings forward the theory that carbon burns to carbon monoxide, setting the hydrogen free from the hydrocarbons.

There is not the slightest doubt, from the work done by Dalton, Blochmann, Kersten, E. von Myer, and Dixon, that, if you explode together gaseous hydrocarbons with a limited supply of oxygen, you obtain carbon monoxide and hydrogen; and it is also probable from H. H. Baker's experiments that carbon burns first to carbon monoxide, but I fail to see that any such theory is necessary to explain the actions taking place in a flame. If we analyze the gases present in the flame ¾ inch above the burner, which is about the point at which increase of carbon monoxide commences, although it is not marked until 1¼ inches up the flame, we find that in the outer zone of the flame we have: Water vapour 24·65 per cent., methane 8·35 per cent.; and a little deeper in the flame, we get water vapour 17·94 per cent. methane 21·51 per cent. From this point up to the 1½ inches, you have the temperature rapidly rising from 750° to 1100° C.; and it is a well-known fact that, if heavy hydro-

carbons and water vapour are heated together, they yield carbon monoxide and hydrogen. Indeed, it is the most expensive method of making water gas, and wrecked one process for the manufacture of illuminating water gas; and one would expect the same thing to happen when methane and water vapour are heated to this temperature. In order to try if this were so, methane was passed through water just below the boiling point, and then through a tube heated to 1000° C. The resulting gases being then analyzed, it was found that the methane and water vapour had interacted to form hydrogen, carbon monoxide, and carbon dioxide; and I should think this is a far more likely cause of the effects produced in the flame.

Taking the facts which I have now laid before you, we may, I think, fairly fully explain the actions that take place in the flame, and lead to luminosity. As the gas leaves the jet, the hydrogen rapidly diffuses to the outer edge of the flame, and burns; the methane doing the same, but rather more slowly. The combustion of these gases raises the temperature 500° C. in the first ½ inch; while before another ½ inch has been traversed, 1000° C. is reached, and the chemical changes in the hydrocarbons are progressing rapidly—the unsaturated hydrocarbons and higher members of the saturated hydrocarbons being rapidly converted into acetylene. If the temperature of the flame were not allowed to rise above 1000° C., this acetylene would be nearly all polymerized into benzene, naphthalene, diphenyl, and other complex bodies, which would be slowly burnt up without liberation of carbon; and a non-luminous flame would result. In the case of a gas-flame, however, instead of remaining at 1000° C., the temperature rapidly rises to 1200° C.; with the result that, instead of polymerizing into more complex bodies, most of the acetylene formed at once splits up into carbon and hydrogen, and the former, heated to incandescence by combustion, gives the luminosity. It is the attainment of this temperature that marks the limit of the non-luminous zone. But if this were the only action, the luminous zone would be very short. The bodies, however, formed from the acetylene before 1200° C. was reached, and the methane, of which some still remains unburnt, are converted into acetylene at a still higher temperature—*i.e.*, 1300° C.; and this being reached near the top of the luminous zone, yields a fresh supply of carbon, and so increases the height of the light-yielding portion of the flame. In producing the luminous flame, therefore, there are two main factors to be observed: First, to use such compounds as shall be most easily converted into acetylene; and, secondly, to attain as quickly as possible as high a temperature as practicable.

The paper read by Professor Smithells was that which he brought before the Chemical Society some months ago on the "Structure and Chemistry of Flames," and noticed in the JOURNAL for Jan. 12 last. He performed a number of experiments on flame, some of which were intended to show the structure of non-luminous flames produced from coal gas or from liquid hydrocarbons when supplied with air. The double character of these flames was demonstrated, as well as the various phenomena observable in the transition from luminous to non-luminous flame. The bearing of this on the chemistry of ordinary flames was also alluded to. The author held that his experiments showed that the doctrine usually taught, that the luminosity of flames was due to the separation of solid carbon in consequence of the readier combustibility of the hydrogen, was erroneous; while, on the other hand, as had been held by previous investigators, the carbon burned the more readily. The explanation Professor Smithells offered was that the separation of the carbon was due to dissociation by heat. He also showed experiments on flame coloration, which gave rise to a new theory affecting some points in spectrum analysis.

SOCIETY OF CHEMICAL INDUSTRY.

Inaugural Address of Professor Emerson Reynolds.

In the JOURNAL for the 26th ult. (p. 149), we noticed the principal points in the Inaugural Address delivered by Professor Emerson Reynolds at the recent annual meeting of the Society of Chemical Industry. We have received from the General Secretary of the Society (Mr. C. G. Cresswell) a print of the address, which appears in the current issue of the Society's *Journal*; and we give the full text of those parts in which our readers are more particularly interested.

The President began by referring to the satisfactory position of the Society, financially and numerically, as shown by the report of the Council. The membership had, he said, reached 2782; the revenue last year amounted to £4134, which was more than it was necessary to spend; and the Society's *Journal* bore record of good work in the Sections. Passing on to notice the losses sustained by the Society by death, the President referred, among others, to Professor Dittmar, Mr. C. Heisch, Dr. C. Meymott Tidy, and Mr. F. C. Hills, whose names had been added to the obituary list, and the mention of whom would, he remarked, recall to mind numerous examples of excellent work in the several departments of analytical and industrial chemistry. He made special allusion to the late Professor Hofmann, who was one of the earliest members of the Society, and whom he characterized as a "teacher of teachers, the source of the primary impulses from which great industries have sprung, the brilliant investigator of some of the most difficult problems in the philosophy of chemistry, the wise counsellor of princes, and the sincere friend of every lover of Nature." Reverting to the Society's *Journal*, Professor Reynolds remarked that it was intended to contain a faithful record of the real advances made during each year in the applications of the science of chemistry to the various arts. So successful had been the *Journal* in this respect, that a presidential *résumé* was rendered unnecessary; and therefore he proposed to take as the theme of his address the modern developments in regard to fuels and their use. This subject was, he said, one which had occupied much of his time and attention for many years; and, besides, it linked in practical interest chemical and other industries with the still wider considerations of social economy. He then proceeded as follows:—

The fuel question is one which concerns those of us who live on the western side of St. George's Channel even more seriously than it does you, as our coal beds have been washed away in ages past, and of native fuel there is practically none save peat. Hence industries which require large quantities of cheap coal cannot flourish in Ireland under existing conditions. It is, therefore, our interest to watch closely the development of improved and economical methods of using such fuel as we can obtain from other countries, and apply them in the utilization of our bulky but abundant peat. It is evident that no other fuels need be considered save coal, peat, and petroleum. Hence my remarks can take somewhat the form of a trilogy, *minus* the dramatic element; precedence being given to the solid fuels, and the first place necessarily to coal.

We are much too prone to assume that coal will always be a cheap fuel, and that the supply is inexhaustible. But both assumptions can be shown to be erroneous. I think it is desirable to briefly indicate the grounds for that statement, as a presidential address necessarily has its public as well as technical aspect, especially in dealing with the topics I have chosen, and therefore needs to be somewhat explanatory, in order to be intelligible to those who do not possess your special knowledge of applied science. Moreover, my general aim being to connect somewhat different lines of work, rather than to attempt novelty, it will be necessary for the sake of completeness to restate much that is already familiar to you.

The reasons for concluding that coal cannot very long remain a cheap fuel are not far to seek. Labour combinations in various parts of the world tend to increase its cost, directly or indirectly. These combinations are to a certain extent the consequences of the operation of economic laws; and in so far are not mere accidental factors. The wider distribution of manufacturing activity tends in the same direction; and the increase in depth from which coal must be won leads altogether and regularly to greater cost of production. Therefore, some causes which are spasmodic in their effects, and others which are continuous, must make coal dearer. The immediate practical effect of such considerations should be to check waste in the use of coal; but I fear we have not gone very far in that direction as yet, since few realize the extent of the danger ahead.

Again, there is the more remote consideration that the world's supply is not, and cannot be, inexhaustible. No doubt "common-sense" people take little account of posterity in such matters, though they will carefully but inconsistently guard the transmission of property in land for hundreds of years in advance. We clearly owe a similar duty to posterity in the right, but not wasteful, use of materials which seem to be absolutely necessary to the well-being of the race.

Now, the world's annual output of coal is about 488 million tons; and the countries contributing to this enormous total are named below, together with the amounts they produced in 1890, unless otherwise specified:—

	Million Tons.
British Islands (1891)	185
America, U. S. (estimated for 1891)	141
Germany	90
France	28
Belgium	20
Austria	9
Russia (1889)	6
Others	9
	488

During the last 20 years there has been a very marked increase in the consumption of coal, which is, no doubt, commensurate with increased industrial activity. Thus, comparing European countries alone, the average annual output for the period 1881-90 was upwards of 62 million tons greater than during the previous decade; and this rate of increase bids fair to be maintained, so that the world's consumption of coal will soon reach 500 million tons per annum, if it has not already done so.

The question arises, How long can this supply be maintained? If, in answer to this question, we cannot give an approximate estimate for other countries, we certainly can for our own. The Royal Commission on Coal Supply, which commenced its sittings in July, 1866, and reported in July, 1871, after inquiring into all probable sources of coal in Great Britain, arrived at the conclusion that not more than 146,480 million tons were available at depths not exceeding 4000 feet from the surface. Therefore, at our present rate of increase of population and of coal consumption, our supply would not last for 230 years.

But Mr. Hall, one of her Majesty's Inspectors of Mines, who has special experience of coal-mining, forms a much lower estimate of the supply practically available with our present means. He considers 170 years as the more probable duration of our coal-beds; and this estimate is based on fuller information than that possessed by the Royal Commissioners. We are therefore justified in concluding that the inhabitants of Great Britain 170 years hence will have little, if any, home-raised coal to burn, if we continue to use it in our present wasteful fashion.

It was pointed out by the Royal Commissioners in 1871 that we cannot suppose "the production of coal could continue in full operation until the last remnant was used, and then suddenly cease. In reality a period of scarcity and dearness would first be reached. This would diminish consumption and prolong duration; but only by checking the prosperity of the country." . . . . "Much of the coal included in the returns could never be worked, except under conditions of scarcity and high prices. A time must even be anticipated when it will be more economical to import part of our coal than to raise the whole of it from our residual coal-beds." As the area of coal-bearing strata in North America is fully 70 times greater than ours, it is easy to see where our future supplies must come from. The rate of increase in the use of coal has been greater than the Commissioners anticipated in 1871; and Mr. T. Foster Brown, C.E., President of Section F. of the British Association at Cardiff last year, has placed on record his opinion that, at the end of only 50 years from the present time, the increased cost of coal will be severely felt. Pessimism is never pleasant; nevertheless we cannot afford to ignore reasonable inferences from fairly ascertained facts.

I apprehend that there are few ordinary consumers likely to be influenced in avoiding waste by the knowledge that we are within measurable distance of the end of our store of British coal; as that calamity may still be some generations off. But the case is very different with large consumers. The inevitable, if gradual, increase in the cost of coal has effectually arrested the attention of those directly concerned in our great industries, or anxious for the maintenance of that manufacturing supremacy to which this country chiefly owes its wealth and power. Keen international competition in trade has quickened the effort to get the utmost work out of fuel, and therefore to diminish waste. No such considerations have, however, produced any effect on the domestic conscience. A spasmodic increase in cost of coal stimulates the use of various economical devices which are almost wholly given up when prices fall back nearly to their former level. A small residual effect is left, which, though slight, is on the right side. But that economy in the domestic use of coal which could not be effected by a patriotic desire to avoid the too-rapid exhaustion of our coal-beds, or by a fear of permanently dear coal, is likely to be brought about by the growing nuisance of large towns—namely, fog, for whose increase our "hearths and homes" are in a greater degree responsible than the much-abused factory chimneys. The primary consideration, in seeking to cope with the fog demon, no doubt is to avoid the production of solid particles during the combustion of any fuel we may use. Hence that method which avoids the formation of smoke at any time, and is both more convenient and economical, must ultimately "hold the field." As you well know, various suggestions have been made for the purpose of avoiding the production of smoke; and it has even been proposed that the use of non-flaming coal should be made compulsory in all large towns, notwithstanding the difficulties known to attend the combustion of anthracite or similar substances in open grates. But even if the fog demon could be satisfactorily exorcised by such means, the fact would remain that the combustion of any solid fuel in an open grate is a most wasteful proceeding. On the other hand, closed grates or stoves have not been popular in these countries. How, then, can we combine economy in the use of coal with smokeless combustion and domestic convenience? The answer is sufficiently obvious: We must more or less completely gasify the coal prior to its complete combustion.

The late Sir William Siemens showed us long ago how to convert coal completely into gas, by means of his great "producer" furnaces; and he demonstrated the applicability of the comparatively poor "producer" gas to operations requiring very high temperatures, as well as to the minor work of steam-raising. Siemens showed that, when so used, one ton of coal can perform as much work as 1·7 tons directly burned. In such comparisons, the "producer" gas was, of course, burned at a short distance from its source, and under the regenerative system. This mode of using coal seems to be the most economical of which we have practical experience. But the gas which is produced seldom contains less than 65 per cent. of useless nitrogen; and therefore it is not rich enough in combustible matter for general distribution.

The Wilson method of gasifying coal, and that employed by the Leeds forge, permit the production of a richer gas. The Wilson process involves the formation of a certain proportion of "producer" gas in raising the temperature of the coal up to the point at which it can decompose steam; and then it affords a mixture of carbon monoxide and hydrogen, or so-called "water gas." The former can be used for steam-raising or furnace-work in the immediate vicinity of the producer; while the water gas can be transmitted through mains as readily as ordinary town gas, and loses nothing by carriage save its initial heat. Thus one general method affords two qualities of fuel, and gasifies the coal in an economical manner.

Whether by the Siemens method in its modern form, or by the more or less complete conversion into rich water gas, a great saving in coal can now be secured in almost all large operations requiring the command of high temperatures; and the use of such gaseous fuel is so steadily extending that we may expect in the near future to reach the maximum practicable economy of coal in our greater industries, and of smoke abatement as well.

Between the complete conversion of coal into gas and the very partial process included in the production of ordinary illuminating gas, is a wide gap which needs to be bridged over, in the interests of the small manufacturer and the domestic consumer alike, before we can secure that economy in the use of coal which we know to be necessary. For it must be granted at once that our ordinary 16-candle illuminating gas is seldom an economical fuel at an average price of 3s. per 1000 cubic feet, though it is capable of being so used as to effect a distinct saving under special circumstances. As an example of its economical use, even near the price stated, I may cite the case of the kitchen of St. John's College, Cambridge, where gas and steam have been substituted for coal, and an annual saving effected amounting to about £80. But in establishments which cannot be systematically conducted, coal gas, at 3s. per 1000 cubic feet, is too expensive a fuel. Several solutions of this important practical problem have been proposed. One group of suggestions involve the supply of two distinct gases—an illuminating and a fuel gas; and therefore requiring two sets of street-mains. But the progress of electric lighting is so rapid that gas companies would not be justified in outlay of capital on a second set of mains. Another proposal is to supply one gas of high calorific value but low illuminating power at a cheap rate; and this gas, when used for lighting, to be charged at the point of consumption with vapours of suitable hydrocarbides. But the true solution involves a compromise much on the lines along which gas managers are at present apparently working.

You are aware that the average produce of 16-candle gas per ton of coal is about 9500 cubic feet. By the introduction of steam to a small extent, the volume of gas can be materially increased, but at the expense of the illuminating power. In order to compensate for this loss, rock or other oils are injected along with the steam, and the illuminating power is maintained. An objection to this practice is that carbon monoxide is present in such gas. But it is also found in many samples of ordinary coal gas; and provided the gas has a strong and characteristic odour, so that its escape can be readily detected, no risk need attend its use. The supply of the richer bituminous coals is steadily diminishing; hence the practice must grow of supplying a modified water gas, instead of coal gas as we have hitherto known it. Better far, in the interests of producer and consumer alike, that the inevitable change in the character of the gas manufacture should be carried out with the full knowledge and assent of the public after due parliamentary inquiry, and in such a manner as to secure the maximum advantage without undue interference with the great monopolies enjoyed by the gas companies. So many satisfactory methods are known by which the illuminating power of a gas can be increased at or near the burner, and gas as an illuminant is moreover being so certainly displaced by the electric light, that the objections hitherto urged against the supply of gas of high calorific value but low illuminating power have almost ceased to have any practical force. On the other hand, the supply of a cheap gas of the kind I refer to would prove a great boon to small manufacturers, as well as to the domestic consumer; and competent gas engineers inform me that no real difficulties lie in the way. The rapid extension of electric lighting in our large towns brings us within measurable distance of some such sweeping change in the character of gas used, in its applications, and in its mode of employment; while the existing mains would serve for its conveyance, and comparatively trifling alterations in our domestic appliances would only be necessary.

It is in this direction, then, that the best prospect of solving a considerable part of the smoke fog difficulty seems to lie; and it is in the same direction that we are to look for true economy in the use of coal. The completion of the system of electric lighting in towns is, therefore, to be desired by the community, not only on account of its great and obvious advantages for illumination, but because it will render possible the provision and distribution of a cheap gas for heating purposes; and the shareholders in gas companies of such fortunate towns should specially rejoice, as herein lies a good prospect not merely of maintaining, but of considerably increasing, their dividends. Gas companies would not only become purveyors of heat energy for domestic use, but for many manufacturing purposes as well—not excepting the production of the electric light.

Hence our duty to posterity and our own immediate interests coincide in requiring the use of more economical methods of using coal; and that which gives promise of the greatest number of advantages involves the conversion of coal as far as possible into gaseous fuel.*

(*To be continued.*)

*Since the above was written, I have seen a short abstract of Mr. Valon's address to The Gas Institute, in which I am glad to find that he takes a somewhat similar view of the situation to that expressed above.

REGISTER OF PATENTS.

Manufacture of Gas.—Dinsmore, J. H. R., of Liverpool. No. 11,740; July 10, 1891.

The claim for this invention is for apparatus for making illuminating and heating gas, consisting of a chamber or vessel containing a separate space for distilling coal, a separate space for distilling tar (or other equivalent hydrocarbon), and a space or conduit in which the coal and tar gases combine, and through which they pass. The result of this separate procedure is that the tar residuals do not become hardened, as they otherwise have been found to do, and the duct can be easily cleaned "and much higher results in the quality and quantity of the gas produced are given."

Fig. 1.

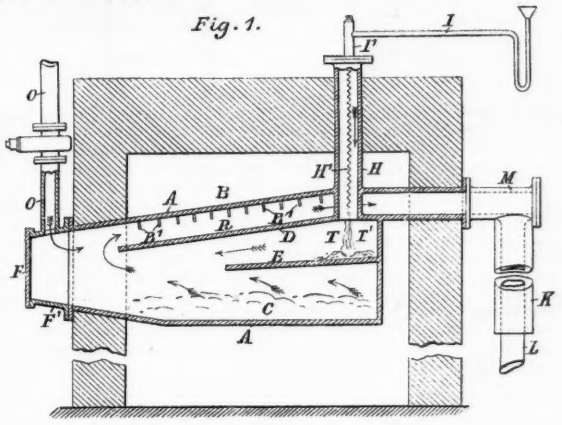


Fig. 2.

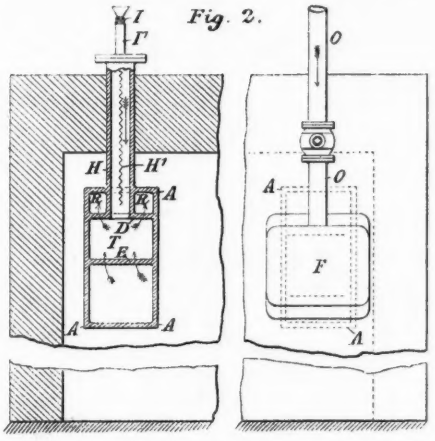


Fig. 1 is a sectional elevation of the apparatus. Fig. 2 is an end elevation—partly in outside view, and partly in cross section.

A designates generally the apparatus or retort in which the combined process of coal and tar distillation is carried on. The coal (as C) is introduced into, and distilled in, the lower portion of this retort. Then between the roof B and the bottom of the retort, are introduced two partial diaphragms or shelves D and E. In the space T between the shelves, the tar is introduced and distilled; while the space R between D and the roof B is the conduit or duct through which the coal and tar gases produced are passed, and by which they are heated and converted into permanent gas. The coal is introduced into the retort through the doorway F and the mouthpiece F^1; whilst the tar is introduced into the space T through a tube H, disposed vertically and towards the back end of such space. The tar, which is supplied through this pipe, is caused to pass through the centre of it, and fall directly on to the diaphragm E; it being fed to the pipe by an ordinary trapped funnel feed-pipe I. H^1 is a wire connected to the pipe I^1 of the device I, and by which the tar is guided centrally down the pipe H. At the outlet end of the retort there is a device by which the combined gases, directly upon leaving the retort, are artificially cooled; constituting part of the outlet-pipe L. This may consist of a water-jacketed part K, through which water is caused to circulate; or cold air, or equivalent means may be employed. The cooling conduit K and outlet pipe L are vertical descending pipes. The portion K is connected directly on to, or springs from, the outlet mouth M; so that the artificial cooling of the gas commences practically instantly upon its leaving the retort. With respect to the passage K, it will be observed that this passage (and the pipe L) are disposed under the mouth M, and cause the gases to descend direct into the hydraulic main below. By providing this artificially cooled portion below the mouth, any pitchy matters in the gases are condensed by it, and flow directly into the main. The effect of these cool condensed matters flowing down the pipe surface is to keep the whole of the pipe from the mouth M to the hydraulic main moist on its surface, and prevents any possibility of a deposition and accumulation of solids thereon. In the reheating conduit, in some cases downwardly projecting webs B^1 are provided, by which the homogeneous mixing of the two gases is facilitated.

The mode of operation of, and effects resulting from the use of, the apparatus are as follows: The coal is distilled in the lower part of the retort (as stated), and the gases given off are instantly heated upon generation, and continued to be heated in passing through the conduit R at the top of the apparatus, and suffer no cooling whatever until the treatment is completed. The effect of this is that the unfixed gases given off from the coal in their nascent state, are subjected to heat before they leave the apparatus without any interruption, and are rendered permanent. The tar falling on to the diaphragm E (which will be red hot with the rest of the retort) is partially vapourized; and the diaphragm being inclined in the manner shown, the unevaporated portion will flow down it, and become almost entirely, if not entirely, evaporated by the time it reaches the free end. Should, however, any unevaporated tar reach this end, it will fall on to the cooking fuel below, and will be there evaporated or coked with the coal. Hence by this construction, it is claimed that if there are any pitch deposits, these can be easily withdrawn with the coke when it is discharged from the retort.

The tar gases, so produced, being in a nascent state, and the coal gases also being in a similar condition, and under the influence of a temperature as hereafter specified, combine very readily, and by continued heating in passing through the conduit, the tarry vapours become fixed. By this combination with both coal and tar gases in a nascent state, and by the continued heating subsequently to the combination, the union of the tar and other gases is permanently made, and results in the production of gas "of a very high and illuminative power and large volume."

The temperature to which the apparatus may be maintained with advantage is between 1300° and 1700° Fahr. Both or all the chambers may be maintained at this temperature; but the quantity of heat which will have to be supplied to the tar-distilling chamber or port of the apparatus to maintain it at this temperature, will be much greater than that required to maintain the gas-heating duct or conduit at the same temperature.

In the illustration, a pipe O is shown on the mouthpiece F^1. This pipe is provided to conduct coal gas—by preference ordinary crude gas coming direct from ordinary coal retorts of a gas-works, or the hydraulic main—into the retort, and to mix with the coal gas made therein. By this manner of working, assuming the illuminating coal gas made in the retort A were of high-candle power, and that being introduced into the retort through O were of lower power (both produced from ordinary Lancashire or Yorkshire coal—not cannel), the passing of the low-candle gas through the heating duct R would raise the resultant combined gas as regards quality. It would be the mean of the two gases; and the proportion of the two quantities could be varied as required, to give the quality of gas desired.

As a modification, the means and provisions just described for distilling tar may be omitted, and the apparatus adapted to distil coal only. This difference of construction is effected by the absence of the diaphragm E and the tube H in figs. 1 and 2. Otherwise the construction of the modified retort would be the same as that described. The process, in this case, is that coal would be introduced into the retort through the doorway covered normally by the door F and the mouthpiece F^1, in the usual way, and distilled. The gas given off would enter the reheating conduit practically directly it is given off, without interruption, and without any cooling whatever; and its heating would be continued in passing through the conduit, wherein its tarry or other non-permanent vapours would become fixed in the manner already set forth. This modified arrangement may also be employed to increase the illuminating power of crude gas (introduced through the pipe O made in ordinary gas-works retorts.

Automatic Liquid Meters.—Reisert, M. E., of Hennef-on-the-Seig, Germany. No. 13,118; Aug. 1, 1891.

This invention relates to apparatus in which the number of times a measuring vessel of given capacity is filled, is recorded by a counting device of any usual construction; and the object is to provide means for securing a minute measuring and correct recording of the exact quantity of the liquid passed through the apparatus. For this purpose within the casing of the apparatus, and above the measuring vessel proper, is a separate vessel or reservoir in which the liquid is stored before entering the measuring vessel proper. In this reservoir a floating body is provided designed to actuate the inlet and outlet valves; and by this means the supply of liquid to the apparatus may be stopped as soon as the measuring vessel is not only entirely but also partly filled, so that there is always an excess of liquid in the apparatus beyond the quantity required for a proper filling of the measuring vessel. The reservoir may also be divided in its height into two compartments, in the lower one of which a certain time before the supply ceases less liquid issues than is discharged into the measuring vessel proper; so that the floating body is enabled to descend even when the measuring vessel proper is already filled.

Lighting and Extinguishing Gas-Burners.—Lake, H. H.; communicated from A. Orling, of Stockholm, Sweden. No. 14,040; Aug. 19, 1891.

This invention comprises an arrangement of lighting and extinguishing apparatus in which the inconveniences usually attaching to such arrangements are said to be obviated. The apparatus ceases to work when the gas is lit or extinguished, even though the pressure upon the contact button is continued; and, at the contact button there is moreover arranged a signalling apparatus, for indicating whether the last operation of the apparatus has caused the lighting or extinguishing of the gas. Thus, for instance, the porter of a house can from his room (and without seeing the burner) light and extinguish a gas-jet on a staircase or similar place which he has to attend to, and this in such a way that he can light or extinguish any of these flames at any time as desired—provided, of course, that the gas is turned on at the main cock or meter.

Fig. 1 [next page] is a side elevation of the apparatus. Fig. 2 is a front elevation. Fig. 3 is an elevation of the opposite side to fig. 1. Fig. 4 is a detail section of part of the gas-cock.

The apparatus comprises an electro-magnet A provided with an armature B. Above the armature is located a sliding rod C, held down by the spring D, and resting with its upper bent point E upon a corresponding point F fixed on an insulated ring G. One conducting wire

is connected to the electro-magnet A and to the insulated ring G; the circuit being continued through the sliding rod C, the body of the apparatus, and another conducting wire or the gas pipe. On the plug of the gas-cock is fixed a toothed wheel I, with which a ratchet K connected to the armature engages. L is an insulated elastic arm bent down at the end, which by means of a conducting wire L^1, is connected with the insulated ring G. The toothed wheel I is provided with two points fixed at the side of it, so as not to touch the ratchet K but come into contact with the insulated elastic arm L. By means of these points, the circumference of the wheel I is divided into two parts of unequal size. While the teeth constituting the smaller portions are passing the end of the insulated elastic arm L, the gas is shut off; but when the other teeth are passing the arm, the gas is turned on. In order that this may be effected, the plug of the gas-cock is provided with a circumferential recess (as fig. 4), whereby the gas is shut off only when one part O of the circumference of the plug is passing the gas channel P.

Fig. 1.

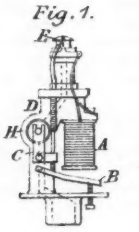


Fig. 2.

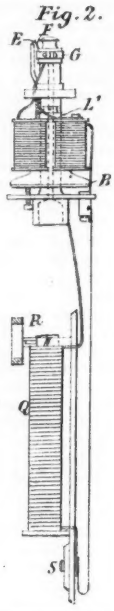


Fig. 3.

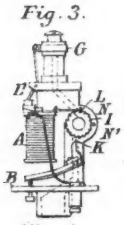
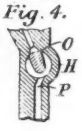


Fig. 4.



The arrangement above described operates in the following manner: Owing to the vibrating of the armature, the ratchet drives the wheel I round; and in this way, one of the points N N^1 will strike the elastic arm L. According to the position shown, this will take place with the point N. When this point strikes the arm L, the circuit will be completed; and as a constant current now passes through the circuit, the armature will be raised as long as the contact button in the circuit is pressed—the gas being thus ignited. When the contact button is released, the armature falls; and on the contact button being again depressed, the raising of the armature causes the wheel I to turn immediately as the ratchet in the last operation of the armature engaged with a tooth of the wheel. Consequently the point N withdraws from the elastic arm L; and the apparatus works in the usual vibrating manner until the other point N^1 makes contact with the arm L, and the apparatus then stops owing to the same reason—the gas being thus extinguished.

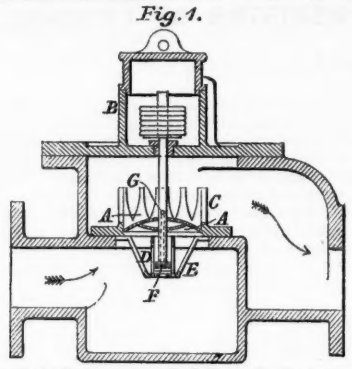
It will be seen that the apparatus, when the contact button is depressed, does not work any length of time, but will soon come to a stop; and that the gas will then be either ignited or extinguished. In order to indicate whether the gas has to be ignited or extinguished, a signalling apparatus is inserted in the circuit, consisting of an electro-magnet Q, the armature R of which consists of a thin plate resembling a telephone. This plate vibrates similarly to the armature B, giving in this way a signal, the length of which would depend upon whether the short or the long distance between the points N and N^1 is passing the elastic arm L. The long signal signifies that the gas is ignited, and the short signal that it is extinguished. It is most convenient to couple the respective circuits of the gas-burners with a signalling apparatus common to all the circuits; and each circuit is then provided with its separate contact-button S.

Gas-Governors.—Peebles, D. Bruce, of Edinburgh. No. 11,001; June 11, 1892.

This invention has for its object to render gas-governors more efficient and less liable to get out of order than hitherto, and to modify the apparatus to suit different requirements, so as in some cases to deal with gas passing through large pipes, in other cases to be suitable for a single burner or a small number of burners, and in some cases to control gas passing downwards through a vertical pipe.

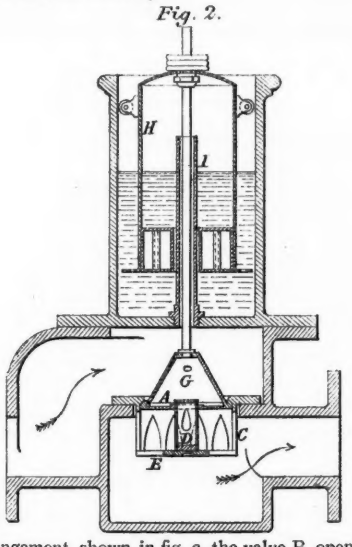
In fig. 1 (for comparatively large pipes), the inlet communicates with the under side of the valve A, which is a disc serving also to be acted on by the pressure for regulating purposes. The valve is made of a segmental spherical form for stiffness, and thin for lightness; and it is strengthened by a small inverted spherical disc, both discs being fixed on a spindle, the lower part of which is tubular. The spindle extends up through the top of the valve-casing, into a box B, in which weights are applied to it. The valve moves up and down in an annular guide C, made with a number of openings of curved form with pointed bottoms. Within the guide, a little below its openings, there is a bevelled seat, on which the valve closes when in its lowest position. The pressure on the outlet side of the valve will be less than that on the inlet side to an extent corresponding to the weight of the valve and its load; and the valve will open or close more or less, according as

Fig. 1.



more or fewer of the burners supplied through the governor are open. If a very few only of a large number of burners supplied through the governor are open, there is apt to be considerable fluctuation with large governors; but it is claimed that such objectionable action is obviated by fitting a supplementary device in connection with the main-valve. This consists of a small cylinder D, fixed below the valve, to a bridge E; and having working in it a piston F on the spindle. The cylinder has formed in its side one or more openings made with pointed lower ends; and one or two small holes G are made above the valve in the tubular part of the spindle. When, from any slight diminution of pressure in the outlet, the valve rises a little (but not high enough to uncover the openings in the guide C), the piston F is raised so as to uncover the openings in the cylinder D; and then a small supply of gas has access into the bottom of the cylinder, and up through the tubular spindle into the outlet space.

Fig. 2.



In the arrangement shown in fig. 2, the valve B opens downwards. It has a tendency to close upwards imparted to it by a floating bell H fixed to its spindle, and arranged in a small tank formed on the top of the valve-casing, and containing water or other suitable liquid. The water in the tank can pass in either direction, through small passages or openings in a disc at its lower end, into the interior of the bell; but the disc nearly touches the side of the tank, and has the effect of more or less retarding the movements of the bell and valve, and thus preventing oscillation. The gas has access into the upper part of the float, from the inlet, through a tube I, up through which the valve-spindle passes. The valve consists of a disc and hollow cone combined; and its periphery works in an annular guide C, having narrow pointed openings, which are inverted as compared with the corresponding guide shown in fig. 1. The small cylinder D fixed to the bridge E is also inverted; and its upper end extends through an opening in the disc of the valve. When the valve descends a little, and before it uncovers the openings in the guide, its disc uncovers on its upper side the points of one or more openings in the cylinder; and then a little gas has access through a small opening G in the cone of the valve, and through the cylinder, into the outlet space. In small governors, the disc must be of much larger area than the valve, for the pressure to act on, in order to obtain adequate governing control.

Fig. 3.

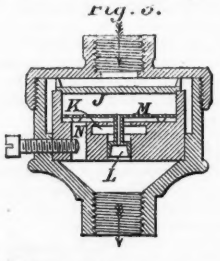
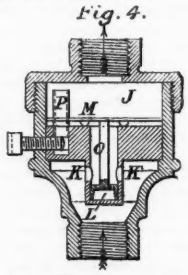


Fig. 4.



In fig. 3 (for downward flow) the inlet chamber, at the top, has within it an inner cylindrical chamber J closed at its top; and the gas

finds its way through the annular space encircling the inner chamber to a transverse passage K below. This passage communicates through an opening with the bottom of the inner chamber, access to which opening is more or less closed when the governor is in action, by the valve L, which is in the form of a cylindrical plug working in a bore in the bottom of the block in which the inner chamber is formed. The valve is attached by a tubular spindle to the controlling disc M, which works in the inner chamber; being made to fit the sides of the chamber as accurately as possible, but without frictional tightness. The gas entering by the passage K acts on the under side of the disc, and then proceeds downwards through a passage N (the free way through which is adjustable by means of a screw). In order to regulate the quantity of gas passing with an increase in the initial pressure, the disc rises more or less, and draws up the valve L, so as to diminish the space through which the gas has access to the under side of the disc. The communication through the tubular spindle of the valve and disc allows the outlet pressure to act on the upper side of the disc, and at the same time tends to keep the valve and the central part of the disc in equilibrium.

In the up-flow arrangement shown in fig. 4, the inlet space at the bottom communicates by ports K with a central vertical passage O closed at its bottom and leading up to the under side of the disc M in the chamber J. From the under side of the disc the gas passes down a passage, communicating by a cross passage with a tube P, extending through the disc to the upper part of the chamber J; the quantity of gas passing being regulated by a screw projecting into the communication between the two passages. A small hole is made through the valve L to put it in equilibrium.

Starting Gas Motor Engines.—Williams, H., of Stockport. No. 15,078; Sept. 7, 1891.

This invention relates to arrangements for starting gas and similar motive power engines—more particularly engines wherein the combustible charges are ignited by means of heated tubes—readily and with certainty. It consists in the combination with the igniting tube of an arrangement of pressure and back-pressure valves attached to the tube, whereby a portion of the combustible charge from the cylinder is, prior to starting the engine, allowed to flow into and through the igniting tube at or about atmospheric pressure, and to be ignited therein, and whereby cold air is prevented from entering the heated tube while the combustible charge is being drawn into the cylinder.

Gas Heating and Cooking Burners.—Clark, S., Hatcher, F., and Challis, E., of Park Street, Islington. No. 16,042; Sept. 22, 1891.

This invention relates to heating and cooking burners constructed on the Bunsen principle: the object being "to obtain more perfect combustion, to increase the heat, and to produce a more steady flame." The patentees propose to take an ordinary Bunsen burner tube, having two long slots in each side for the escape of the mixed air and gas into a flat chamber. In the top of this chamber is formed a number of holes, provided with short tubes, similar to those already in use; and in the bottom are a corresponding number of holes opening into tubes passing up centrally through the short tubes—the mixed air and gas passing up between the two tubes and being burnt at the top. The inner tubes supply pure air to the centre of the flames; and in this way, increase the heat and cause the burners to be more steady, and thus obtain more perfect combustion of the gas supplied to them.

APPLICATIONS FOR LETTERS PATENT.

13,527.—Gary, P., "Glasses or glass chimneys for lamps, gas-burners, and other lighting apparatus." July 25.
13,656.—Gary, P., "Gas-burner." July 27.
13,686.—Cuyper, E. De, "Collecting ammonia and ammoniacal salts from gaseous and liquid mixtures." July 27.
13,697.—The Lamp Manufacturing Company, Ld., and Welch, W. H. I., "Gas-lamps." July 27.
13,751.—Holroyd, J., and Wiseman, E., "Water-meters." July 28.
13,769.—Stringer, T. H., "Converting a gas-engine into an oil-vapour engine." July 28.
13,859.—Binns, J. P., "Self-starting gas-engines." July 30.
13,907.—Coney, J. R., and Hope-Jones, R., "Lighting and regulating the supply of illuminating gas." July 30.
14,079.—Rowbotham, W., and Bradley, J., "Gas motor engines." Aug. 4.
14,107.—Paasch, H., "Liquid and gaseous meters." Aug. 4.
14,140.—Hull, L., "Cocks for water-pipes." Aug. 4.
14,141.—Rowbotham, W., and Bradley, J., "Gas motor engines." Aug. 4.
14,174.—Bowing, J., "Manufacture of coke and the recovery of tar products." Aug. 5.
14,218.—Dick, W. B., "Gas-pipes." Aug. 6.
14,219.—Dick, W. B., "Gas cooking-stoves." Aug. 6.

An Indefinite Postponement of Electric Lighting at Barnsley.—At a meeting of the Barnsley Town Council last Tuesday, the Park and Lighting Committee recommended—"That the electric light be installed on a site in Beckett Square at an estimated cost of £18,382, but that at present only £13,332 be expended; that Mr. A. Bromley Holmes be appointed the Electrical Engineer, and be instructed to prepare plans, specifications, and estimates of the electrical plant, and that the Borough Surveyor should prepare plans, &c., for the requisite buildings." The Committee further suggested that application be made by the Council to the Local Government Board for their sanction to borrow the sum of £18,382. The Mayor (Alderman Blackburn), as Chairman of the Committee, moved the adoption of the minutes. A long discussion followed, in the course of which Mr. Raley said he thought the minutes should be referred back to the Committee, in order that they might consider the desirability of applying to an electric lighting company to supply the town, seeing they had facilities given them under the Act. Mr. Halton followed, and moved—"That, in consequence of the high rates now levied, the question be postponed indefinitely." Mr. Sykes seconded the amendment, which was eventually carried.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

"Smokeless London."

Sir,—If I had known, when writing my humble little article on "How to Make London Smokeless," for the *Gentleman's Magazine*, that it would have caused any stir, and called up so much criticism, I am perfectly free to admit that I should have gone more deeply into my facts. I should have studied the subject more thoroughly, and should have more fully digested my scheme, before springing it upon an incredulous public.

Of the criticisms that have come under my notice, the two most important are the long leading articles contained in the Journal of Aug. 2 and in the *Lancet* of July 23. Both of these go thoroughly and deeply into the subject; and, being the highest possible authorities upon the stand they take, it would seem unwise to gainsay them. I also see plainly the justice of many of the remarks contained in each of these articles; and the criticism is evidently unbiassed. But I must beg to be allowed to justify myself upon one or two essential points.

In the article referred to, I have said: "A ton of the coal weighs a ton (naturally); convert it into gas, and it comes at once as a decimal in gravitation, and could be conveyed in mains at a very small expenditure of price per mile." This you think indicates that I do not realize that the gas produced in the ordinary way from a ton of coal weighs upwards of 350 lbs.; while the *Lancet* says that this claim is like the old catch question: "Which is heavier, a pound of feathers or a pound of lead?" Perhaps I have not turned this sentence so well as I might have done; and it is easy for a chemist to pick it to pieces. But you must remember that I was writing a popular article; and I think that the general public would quite follow my meaning—namely, that the weight of coal gas comes as a decimal in comparison with the weight of air upon which specific gravities are based. Of course, personally I know well enough that, weighed under the conditions usual in specifying atmospheres, the gas extracted from a ton of ordinary coal would probably represent 370 lbs. or so; but the ordinary individual who hunts for a gas escape with a lighted candle would not be likely to realize the fact until it struck him. Again, probably the average man would want proof of the fact, in the following way: A ton of coal should be placed upon one side of a pair of scales, and a pipe weighing one ton upon the other. These exactly balance. Now charge your pipe with the gas extracted from another ton of coal; and the surprising fact remains that, although you have added about 370 lbs. in weight, your pipe which originally weighed a ton has become lighter than before. You must remember also that the public have long been accustomed to believe that there are but 19 cwt. in a ton of coal; so the above experiment would open their eyes to an enormous extent.

Again the *Lancet* says: "The force required to pump gas through hundreds of miles of mains is far greater than is generally supposed. The resistance offered by so great a length of piping would be enormous, and the gas would suffer considerable compression before any effect of initial pressure would be felt at the extremities of the mains." You take safer ground, and say (vaguely) that gas "cannot be driven through miles of main for nothing." Of course, this depends chiefly upon levels. There are many places where gas is sent out upon a district of a slightly higher level than the holder; and the same pressure put on at the governor may be registered at the burner in the consumer's house. Where the ground is gently rising, not only may gas be conveyed actually *without* expenditure of force; but it will *gain* several tenths in pressure in as many miles. For instance, Oxford could be supplied from London, probably, by a very trifling expenditure of energy; but it would take far more pressure to return the gas to London. But to propel gas in pipes along the level is no serious affair; and upon this ground my scheme could not possibly be condemned as impracticable.

The *Lancet* continues: "If a person blows through a length of leaden pipe, he will find that a very considerable effort is required before the air at the other end of the pipe is forced out." This, of course, is so, if the pipe be of "very considerable" length. But I take it that, once having forced out the "dead" air, the current may be made continuous by a very trifling expenditure of force. Also, should it be found that the pressure necessary to convey the gas in one straight drive of 100 miles, compressed it to such an extent that its heating and lighting qualities were affected, and that the loss from leakage, &c., became serious, what would be easier than to place exhausters at intervals of 30 miles or so along the main? This would not be a serious outlay; and they could be maintained at small cost to keep up the continuity of pressure. Many other arguments I could bring to bear; but I recognize that I am merely wasting time, and have simply said so much to justify myself. Of course, I did not know that the late Sir W. Siemens had thrashed out the same ground, or I should not have advanced the scheme of carbonizing at the pit's mouth as original. But there is nothing new under the sun; and if that "bold innovator" could not make the thing go (though perhaps the time was not so ripe then as it is now), and if two such eminent journals now pronounce the scheme impracticable, I am content to let it rest with this parting shot—probably the "various and manifold aspects—political, social, and economical"—which you think I should have studied more thoroughly—may all be summed up sufficiently for the ordinary individual in the fact that something over twenty millions of money is invested in London and suburban gas plant and machinery. This is by far a greater argument of the impracticability of the scheme than if Durham were bounded upon the south by the Rocky Mountains.

But all this is no argument against the fact that London may be—aye, and ought to be—a smokeless city; nor against my statement that it is not *cure* but *prevention* of the evil that should be aimed at (or enforced) by the substitution of gaseous for solid fuel. I believe also that (as I have tried to demonstrate in my article) such an innovation would establish a great law in our domestic economy, and, like the Heathen Chinee, "the same I am free to maintain." But these things want explaining to the general public. The gas consumer needs education upon matters relating to heating and cooking by gas; and especially he wants practical hints put in popular form—

not in a business way. No matter how practical an idea or suggestion may be, the public will not take it kindly if it comes to them in the shape of a trade notice, or if it appears to them to be in any way connected with business. But neither gas companies nor gas-stove manufacturers seem to recognize this fact. What, for instance, is the benefit of gas-stove exhibitions—about which there is indeed a great deal of bogus—excepting to the particular manufacturer making the exhibit? What is the use of one good maker running down the goods of another equally as good? Amongst the first half-a-dozen makers of gas-stoves there can be very little difference. The business does not allow of a great deal of scope, nor does it require a man with a high mathematical degree to devise a gas-stove that shall be perfect as far as results are concerned. It is the duty of all gas companies to see that the burners upon all stoves *are* perfection. Gas mixed with air in the right proportion gives a certain attainable result. There can be no such thing as one *perfect* burner being better than another; and it is obviously to the advantage of the gas companies to see that every make of stove is such that the greatest possible heat will be given for the amount of gas consumed, before it is allowed to be placed upon their hire-list. These are the kind of facts that the public should know. They should know that all stoves let on hire by a gas company are equally efficient in proportion to the amount of gas burnt; and so the only things to look at, in making a selection from the various makes, are design, elegance, and general construction (in which, of course, most tastes differ), and above all and everything the consumer should choose the stove that may be most easily kept clean.

In all matters pertaining to the economical use of gas, cleanliness is one of the most essential points to bear in mind. Every gas-burner needs a brush up now and then, or carbon forms round it, and then the best results are not attained; and with a cooking-stove, the top bars should be removed every morning, and the burners thoroughly brushed and cleaned—especial attention being paid to the holes—before the stove is used. No stove will smell if thus fairly treated. The oven of a cooking-stove should always have a flue leading into a chimney. All gas-fires must have a good flue; a perfect draught; and an excellent supply of gas.

Here are some facts: In my own little house all the cooking is done by gas. I have a gas-fire in my study, and five burners are in constant use when necessary (that is to say, between dark and bedtime); and my gas bill has not reached £8 a year, nor do I intend that it shall. So if all London people were to use gas as I do, they would find it economical, and have the advantage thrown in of a smokeless city.

Public Opinion gives me credit for advancing some "rather practical ideas;" but, on the other hand, the *Whitehall Review*, in criticising the same article, asks whether we are to give up our pleasant open fires, and questions my assertion that meat cooked by gas is generally better than that cooked by a coal-fire for the reasons given in my article. To this, I answer: Certainly. Open coal-fires should be given up within the city, because of the evils that they create. These, Dr. Oswald, in a letter to the *Lancet* (in which he thinks that the community should thank the editors for the timely remarks of their leading article), describes graphically. "The evils of London smoke and smoke fogs," he says, "are universally bewailed; the damage to valuable books, furniture, and pictures, the grimy appearance of our public edifices, the greasy black mud of our streets, the flight of wealthy people from town for many months, the gloomy depressing skies, the choking atmosphere, the pallid looks of the regular denizen, the direct injury to health, increased mortality, the interruptions to traffic, the loss of trade, the dangers of accident, the encouragement of crime, the diminution of sunlight, the consequent decrease of animal and vegetable vitality, and other almost innumerable bad results. Is it not strange, then, that the community, though loudly complaining, takes no steps to heal this ever-magnifying sore?" It is strange! It is stranger still the *Whitehall Review* should glory in helping to create all this evil and misery by its open coal-fire, when the *Lancet* says: "Unquestionably the employment of gaseous fuel would be a means of obviating the evil."

Again I quote from the same journal: "One way out of the difficulty, however, seems probable; and that is, that until some other source of power becomes available, coal or solid fuel, so long as it lasts—or it may even be liquid fuel—will after all be resorted to solely for the purpose of distributing a force which may at will be resolved into either radiant or calorific energy. We refer to the immense advances recently made in electricity, which promises to provide us not only with light in our homes, but also with heat that will be available for the purposes both of cooking and heating." Now, with regard to electricity as a heating and cooking agent, I cannot be brought to believe that middle-aged men like myself will live to see its adoption by all classes of society. Can it be produced cheaply enough? And will it not always remain a dangerous element to tamper with? These points remain to be proved. In the meantime, are we of this generation, who are unfortunately so placed that we are forced to earn our bread in the Metropolis, every winter to submit to all the manifold evils of London fogs when "unquestionably the employment of gaseous fuel would be a means of obviating the evil?" I am country born and bred, and until recent years have lived an open outdoor life surrounded by pure and healthy atmosphere; so perhaps I feel it more than others do. But if all men in London dreaded the approach of winter as I do, they would rise up in arms when they saw that there was "a means of obviating the evil," and fight until it was accomplished.

Aug. 11, 1892. LYNN CYRIL D'OYLE.

Mr. Gadd's Mechanics,

SIR,—From Mr. Gadd's last contribution to the JOURNAL, it is plainly evident that he has not studied the subject of the *moment of inertia* in complex beams and cantilevers, and the problems allied thereto, or he would not take the formula given by Mr. Cripps on p. 994 of the JOURNAL for Nov. 11, 1890, and apply it to a question for which it is clearly not intended, and has nothing in common, and to which no one fairly educated in mechanics would ever dream of applying it.

Muxton, near Newport, Salop, Aug. 13, 1892. R. J. MILBOURNE.

"Is a Gas or a Steam Engine the more suitable Motor for an Exhauster in a Small Gas-Works?"

SIR,—I was surprised to read in your report of the meeting of the North British Association of Gas Managers, the answer given by the Committee of that Association to the above question, which would seem to have been put into their Question-Box at the last annual meeting. It seems "passing strange" that men, professedly striving to popularize the use of gas for all purposes, should deliberately advise the managers of small works to use a steam-engine, when they might introduce a gas-engine, which would be in itself an advertisement, and would enable them consistently to advocate their employment by other users of small power. On this ground alone, I think the Committee should have recommended the gas-engine.

It is rather singular that one finds these engines almost everywhere except in gas-works. The reason why, I cannot tell; but it seems to me a standing reproach to our profession, that this valuable friend should so persistently receive the cold shoulder, as there are really but very few gas-works which one can visit to see a gas-engine at work, although there is scarcely one beyond the very smallest village works which might not employ one of these motors for some purpose or other, and thus show the engineer's faith in his own manufacture. But, apart from all this, I think most decidedly that managers of small gas-works, when putting in an exhauster, would be well advised to use a gas-engine for the motive power. It is cheaper than a steam-engine for fuel and attendance; more cleanly; and costs less for repairs.

I have had a 3½-horse power Crossley gas-engine driving my exhauster, &c., for nine years, which is equal to about 25 years' ordinary work; and, beyond the periodical re-facing of the slide-valves, and a set of new piston-rings, it costs me nothing for repairs. Last winter, I realized that this engine was pretty well worn, and would require to be overhauled, which I intended to have done this season. But after consideration, I determined to turn it out, and get a new type engine, of the same power, without the slide-valves. This I have done; and the new engine is now driving my exhauster most beautifully. This might be considered wasteful, and not at all cheap as regards repairs. But I have now got a completely new engine of the most economical type; and if it serves me as well as its predecessor, the extra expense will only average about £3 per annum.

The consumption of gas by the old engine was originally 50 cubic feet per hour—latterly considerably more; the consumption with the new engine is 30 cubic feet per hour, or 720 cubic feet per 24 hours. This costs us—taking account of coal and lime only, which is really all such gas costs extra—1s. 1d. per 1000 feet, or about 9d. per 24 hours. We could not possibly have steam power as cheap as this.

Again, the engine requires practically no attendance. My yard foreman keeps it clean, and oils it twice a day; stopping it once in 24 hours for a few minutes, to replenish the crank oil-cup. The leading stoker gives it what attention it requires during the night. There is no boiler-fire to be neglected; no danger with it; and altogether it throws practically no extra work on any one.

When I introduced my gas-engine, there was only one in this city, and that of an antiquated type, which was anything but an advertisement. Now there are seven; and the last to be erected was a 20-horse power one for driving a large saw-mill, and which consumes about a million cubic feet of gas per annum at 3s. 6d. per 1000 feet. This one was got directly through an examination into the results of our exhauster engine.

I would, therefore, most unreservedly advise any manager of a small gas-works at any rate—let the engineers of large works please themselves—who is contemplating the introduction of an exhauster, to drive it by means of a gas-engine.

I think it is a pity that gas-engine makers do not encourage this branch of business by manufacturing combined gas-engines and exhausters, just as other makers combine steam-engines and exhausters.

Armagh, Aug. 5, 1892. JAMES WHIMSTER.

Gas Companies' Accounts.

SIR,—Mr. W. Livesey's letter in your last issue opens a question that has for some years had great interest for me. I have often wished that I could reduce the accounts of other companies to a common standard, to enable me to compare their results with our own; but, unfortunately, there is too often some item that I have to assume or estimate, which makes the whole set of figures uncertain. The missing item is generally the "total quantity of gas sold;" and the Schedule to the Act of 1871 does not provide that this need be given. With this exception, it seems to me any set of accounts made out in strict accordance with that Schedule can be easily analyzed by anyone.

I can scarcely agree with Mr. Livesey that the division of the accounts into "manufacture," "distribution," &c., does not answer any useful purpose. On the contrary, it seems to me very useful. If the whole expenditure were lumped together as "coals" and "working expenses," a variety of items, over some of which the engineer has no control (such as rents, rates, directors' fees, &c.) would all figure as his "working expenses;" and surely it is valuable to know whether the extra cost in any place arises at the works, in the district, or (as I may perhaps express it) at the office.

Another point to which I would like to call attention is the erratic manner in which expenses on delivery, &c., of residuals appear in various accounts. The Act of 1871 shows these expenses *deducted from the returns*. This appears to me far the best, as then the revenue from residuals is seen at a glance. But many companies charge "cartage of coke" and "manufacture of sulphate" on the debit side. In such cases, Mr. Livesey's shortened analysis would throw these amounts on to the working expenses, and leave a heavy amount on the credit side, as "sale of residuals," which would be most misleading.

I should be very glad indeed if some simple and uniform system of analysis could be agreed upon, and if through your columns, or the medium of one of our Institutions, we could each be able to compare our own results with others. I have long done this with acquaintances, and would like to see it more general.

I am not an engineer or manager, I only deal with

Aug. 12, 1892. "FIGURES."

MISCELLANEOUS NEWS.

THE ROYAL COMMISSION ON LABOUR.

Wednesday, Aug. 10.

(SECTION C.—*Present: The Right Hon.* A. J. MUNDELLA, M.P., *Chairman; Sir* F. POLLOCK, *Mr.* L. COURTNEY, M.P., *Mr.* T. BURT, M.P., *Mr.* M. AUSTIN, *Mr.* E. TROW, *Mr.* G. LIVESEY, *and Mr.* TAIT.)

Additional Evidence relating to the Gas Industry.

In the JOURNAL for June 14 last we concluded the report of the evidence so far given on behalf of the gas industry before the above Section of the Labour Commission. The Commissioners having, however, decided to hear further witnesses, these were called to-day.

Mr. *T. W. Gardner*, Secretary of the Gas Workers' and General Labourers' Union, Plymouth, said he believed it had been given in evidence before the Commission that the origin of the strike at the South Metropolitan Gas-Works was the bonus scheme. There was not the shadow of a doubt that the scheme had something to do with it; but he believed the fundamental origin of it was the breaking of an agreement, either by Mr. Livesey or with his sanction, by Mr. Carpenter, the Superintendent of the Company's Vauxhall works. The agreement was made in September, 1889, and was between the Directors of the Company and the Union men—the stokers. It was to the effect that Union men should not be compelled to work with non-Union men any more than that if a man came and started work he should be allowed seven days to say whether or not he would join the Union.

Mr. LIVESEY: That statement of the agreement is right.

Witness: At the expiration of the seven days, if the man did not think fit to join the Union, he (witness) believed he was put on again, and the non-Union men were to work by themselves. Three men working at Vauxhall refused to pay their contributions; and when they were asked for them, they said they did not intend to pay. He understood it was suggested that they should either pay up their contributions or be put to work in a gang by themselves, and not with the Union men; and Mr. Carpenter replied that they would be protected by being kept on as they were. That was the origin of the strike. The strike had been contemplated before; and it was a well-known fact that, when they met at the Cannon Street Hotel on Nov. 4, 1889, about the double time, Mr. Livesey said deliberately——

Mr. LIVESEY: I was not there; my brother was there.

Witness: Mr. Livesey said he would give in to them under protest; and from that day there could be traced the commencement of Mr. Livesey's attempt to smash up the Gas Workers' Union by scouring the country and getting people as recruits ready against the strike taking place. The first body of men who arrived in London for that strike were eleven in number, and they came from Sittingbourne. These men were persuaded to come to London under the pretence that there was employment for them at the South Metropolitan Gas-Works. He (witness) left Canning Town for Sittingbourne to try and prevent any more men coming up. On the 9th of November, when they were all met in conference in the Committee-room in the Old Kent Road, they received a letter from Hitchin; and he went down on the Monday night to try and prevent men from coming up. He went from there to Cambridge, and found that there were some men already recruited by the aid of the Poor Law Guardians and two ministers who had been helping to get men to go to the South Metropolitan works. On that night there was a meeting held in the Coffee Palace, in New Street, Cambridge, to arrange for these men leaving the next day. The agent came there to see the men; and in less than an hour afterwards some of them were drunk, and fighting in the streets. Where they obtained the money from, he did not know; but he knew the agent took in some money in a bag. The next morning when they were going away from Cambridge, he went to the railway station to see them off, or try and prevent them going. The agent was allowed to stand on the table in the waiting-room of the station to speak to the men before they came away; but he himself, who was there to prevent them going, was ordered out by the station master, who threatened if he did not go to lock him up.

The CHAIRMAN: I understand you complain that the man who was in charge of these men was allowed to speak to them and you were not, and that this was done by the railway authorities?

Witness: The railway and police authorities. These people had every assistance from the police, both in the country and in all other places; whereas we, who were standing up for our own legal rights, had no assistance, but in every case the police were ranged against us, although we did nothing wrong.

The CHAIRMAN: But the police were there to protect those men against any violence or intimidation.

Mr. LIVESEY: The strike took place on the 13th of December; but these men came up a week before. Did you know that at our Rotherhithe works we had great difficulty in getting men before this strike?

Witness: No; I did not know it.

Then did you know that an agent was sent down to Sittingbourne to try and get brickmakers, not for the purpose of taking the place of strikers, but for getting men to do our work?—No.

Mr. LIVESEY: These eleven men were asked to come for that purpose.

Mr. *J. Marsh* and Mr. *D. Saggers*, employed at the South Metropolitan Gas-Works, were next called. In reply to the Chairman, Marsh stated that he had worked for the Company for three years regularly, and for 14 winters as a winter hand. He had come entirely of his own free will, and without consultation with anybody. He wished to give evidence with reference to the action of the Union at the time of the strike. He was a non-Union man himself; but he had belonged to the Union until the strike took place. The agreement that was signed was that the unionists were to remain at the same rate of wages, and do the same work as, and not to interfere with non-unionists, for twelve months. Things went on very well for about five or six weeks, and then a man was discharged at the Vauxhall works, owing to his not doing his work properly. The men all gave in their notices, which, however, were allowed to be withdrawn again. Their next step was with regard to double time, instead of time-and-a-half, for Sundays, from six in the morning till six at night. They also demanded double time from six till ten at night—the half-shift. They demanded double pay for the four hours' work. Then as to the bonus that was offered them, they would not have it unless it was put on the wages weekly. They demanded the discharge of all non-Union men; and when their demands were not complied with, they gave in their notices again, and came out on strike. The men on strike threatened with violence those who did not go out.

The CHAIRMAN: Then you were a member of the Union until such time as they refused the bonus system, were you?

Witness replied that he was, till after then—till after the strike took place. He did not approve of the men not keeping the agreement they had signed; neither did he approve of the demand for increased pay for Sunday labour. He himself was not spoken to about it; only the delegates of the Union were consulted, and not all the members. There were seven or eight delegates from the Old Kent Road works. When the other men struck, he decided to remain at work; and he had paid no more money to the Union since. He was quite satisfied with his present employment. There had been no more work put upon them; and there was the same rate of wages paid as before, with the exception of the double pay. They also had the advantages of the bonus system. His bonus account had amounted in all to £9 6s. He believed the men employed were generally satisfied with this system. More wanted to sign than there was room for. Two or three days after the men went out on strike, about three parts of them wanted to come back again. The men had, he thought, made a great mistake; all he had spoken to wished to return.

Saggers stated that at the time the bonus system was spoken of, the men had a meeting at the offices of the Company. The delegates said they had decided to obtain the bonus on their weekly wages by striking. They intimated that all who did not join them should neither work there nor anywhere else; and he himself was threatened. The new hands that had come in to replace the strikers were a credit to the place as compared with the others. They were a better class of hands, and better workmen. They did not go in intoxicated on the Saturday or Sunday night after getting their pay, as the old hands used to do.

Marsh said his wages were 5s. a shift; and he calculated he earned £85 a year and his bonus.

Mr. TAIT: What were your wages before the Union started?

Witness: The same.

Was there any difference in the hours of labour?—They were twelve hours till the eight-hour shifts were started in July, 1889. We had the same wages for the shorter hours.

Is there much difference in the amount of work done?—There is a considerable difference. We had two-thirds of the work that was formerly done in some of the machine houses. There were 80 retorts as against 112.

Mr. LIVESEY: 80 against 90; we took off one-third of the work.

Mr. TAIT: Was there any reduction or advance of wages when you were put on to the eight hours?—No.

How long, Mr. Saggers, were you working with those men whom you have condemned so much?

Saggers: I have been at work in the retort-house close on 17 years.

You were 17 years working there; and it was only on the occurrence of this strike that you found out all their bad qualities?—I found them out before.

Do you think they would have been retained in the South Metropolitan Gas Company's service for such a length of time if they had all those bad qualities?—[No answer.]

The CHAIRMAN: Do I understand you to say that three men out of four would occasionally—not regularly, but occasionally—go to work intoxicated?

Saggers: They would. After they had their money, they neglected their homes, and got beer, and then came to work; but the new men conduct themselves much better.

Mr. LIVESEY: When you said three-fourths of the men were drunk, you did not mean they were what might be called regular drunkards, but men who spent a good deal of money in drink, did you not?

Saggers: Yes.

There are two points I wish to have made quite clear to the Commission. I have had nothing to do with bringing you here, have I?—Not in the least.

With regard to the proposal for an eight-hour shift, do you know that about a year before the Union was started I had proposed or suggested the men should work on the eight-hour system?—Yes.

Mr. *W. James*, the next witness, stated that he was a stoker in the employ of The Gaslight and Coke Company, and worked at Beckton. He had been in their service since 1877. He was not, and never had been a member of a Union. He had taken part in several disputes—one, which took place in 1882, having originated in a petition to the Company for a reduction of work. The matter was placed before Mr. Trewby, the Chief Engineer; and the men obtained a reduction. Prior to 1881, the first offer of an eight-hour day was made to them. Before that they were working on the twelve-hour shift—two shifts constituting the 24 hours. The offer was not accepted for some reason, he did not know why. In 1886 they petitioned the Company for an extension of their annual holiday, which had formerly been one day only. The petition was granted, and seven days were given to them, during which time they were paid seven days' money. In 1889, they started an eight-hour shift without any reduction of wages.

The CHAIRMAN: What have your wages been since 1889?

Witness: The same as before, except that there is 1s. 2d. difference in the wages of three men, who constitute a gang. Their position is very much better now than it was prior to 1889. There is no loss of time now. Under the twelve-hour shift they had 84 retorts to draw and charge per gang; now they have 72 retorts—a reduction on what was first offered by the Company.

That is a reduction in the quantity of work produced, and of one-third in the number of hours?—Exactly.

Have you Union and non-Union men in your works?—Yes. There were in the carbonizing department only two men who did not join the Union in the first instance. Of course, there are also men who

have not paid up their subscriptions; and this fact is recorded on their lockers. There are some men twelve months in arrear; and they do not call them Union men.

Do the Union and non-Union men work peaceably together?—No; they do not. I do not consider it just and honourable that a man should be hounded from pillar to post because he is a non-unionist. When a man does not belong to the Union, he is hooted and howled at, even when he is out with his wife and children. I myself have experienced persecution of this character; and though this occurs now perhaps only once in a fortnight, it used to be a daily occurrence.

What kind of persecution are you subjected to? Is it that the men call vulgar names after you?—Everything of that description, or bringing a band and playing the Dead March in Saul outside your window on Sundays.

Have you ever had any promotion during the time you have been with The Gaslight and Coke Company?—No. My pay at present is 5s. 7d. per day. I work two weeks six days, and one seven—the one amounting to £1 19s. 1d., and the other to £1 13s. 6d. per week.

Mr. LIVESEY: That is scoop driving?

Witness: Yes; 5s. 7d. is the scoop driving pay.

At Beckton there are 3000 or 4000 men in the winter, are there not?—I should think so. The number varies with the mildness or the severity of the winter. Of the men in the carbonizing department not 1-90th do not belong to the Union.

The CHAIRMAN: Would there be three out of four generally who are unionists?—Yes; there might be. I think the number of unionists is rather increasing. There used to be more, as when the pressure was put upon them, they were bound to join. The circulars posted on the locker doors of the men who have not paid their contributions show that there are men owing 12, 13, and 14 months' contributions.

Mr. COURTNEY: Do you remember when the gas stokers were in prison?

Witness: That was in 1872; but I was not in the trade then. I have heard about it. The Union was very strong then—every man that was in the gas industry being, I believe, a unionist.

In reply to further questions, witness said that, when the eight-hour day was first proposed, it was offered to the old men; and he did not know what was the cause of their rejecting it. The Company thought fit, as the men did not seem willing to take the eight-hour day in 1881, to give a gang of men the opportunity of trying it as an experiment in the No. 4 retort-house at Beckton. The gang were going to start; but the other men, hearing about it, crowded into the house to see the new system commenced. The consequence was that the gang thought they were being made a laughing-stock of; and being an ignorant class of men they would not start work. In 1887 the Company took a vote on the subject—every man having to vote for or against the eight-hour day with a reduction; and he believed the South Metropolitan Gas Company offered it about the same time. The reduction was four mouthpieces; and if this did not suit them, they were to have a further reduction, bringing the number down to 76 mouthpieces. That was ten minutes of actual work before the retorts; and the men were often done in less time than this. There was no reduction whatever in the wages. Of the men who were in the gang that was to have started, there were five still employed; but they would not come before the Commission to give evidence, because they were staunch unionists. Asked why he was not a unionist, witness said because he did not see the necessity to form a Union in a place like Beckton, where any petition that was placed in the hands of the Directors, or entrusted with the Engineer to be taken to the Directors, was always conceded. The men were not refused the concessions for which they petitioned. They were asked to have an eight-hour day; and what could they want more? There could not, to his mind, be anything fairer and more honourable than their treatment by the Company; and that was the reason he did not join the Union or help them in any shape or form.

If you did want any change made, you would probably be able to put it before the Directors more forcibly if you were in an organized Union, would you not?—Pressure of that description may be used in some classes of industry; but not very freely, I think.

Have you any sick funds amongst the workers?—Yes, we have a Benefit Society. It is under the Company; and they contribute an amount towards it every year. The fund is managed by the Secretary. They have a Committee composed of the different classes of workmen; and that Committee transacts all the business for each works.

Is that for sickness only?—For sickness and death.

And is there any provision for old age?—No, there is nothing for that. The Company, I believe, grant that independently of the men.

Do they pension their old workmen?—They do, out of their own money, I believe. There are several pensions now; but I do not know how many.

Mr. LIVESEY: At one time, nearly all the men in the retort-house belonged to the Union, did they not?

Witness: Yes, with the exception of two men, in 1889. There are a great many who are not members now. It is my opinion that no trust can be placed in men who join the Union and then fall out, for if pressed again they would join again. I would not place confidence in a man who first of all said he would not join a Union, and afterwards did it.

The Commission then adjourned.

Electric Lighting in Lancashire Boroughs.—The Blackburn Corporation have decided to proceed at once with a scheme of electric lighting, and application is being made to the Local Government Board for sanction to a loan of £50,000 for the purpose. The Blackpool Corporation are making application to the same Department for power to borrow £26,000 for developing their system of electric lighting. The Nelson Corporation, having received the necessary sanction for a loan of £3900 for electric lighting purposes, are preparing to proceed with the work at once. A site has been secured in connection with the present gas-works; and a Sub-Committee has been appointed to carry out details. At Oldham an inquiry has been held on the subject of an application by the Corporation to the Local Government Board for power to borrow a sum not exceeding £40,000 for electric lighting purposes. There was no opposition.

SOUTH METROPOLITAN GAS COMPANY.

The Half-Yearly Accounts.

Accompanying the report of the Directors of the above Company for the half year ending June 30, 1892 (as given in the last number of the JOURNAL), were the usual statements of account, which will be presented at the meeting of shareholders to-morrow. As on previous occasions, we merely note the changes in those portions which are subject to but little alteration; reproducing the remainder in full.

Statements Nos. 1 and 2 show the amount of share and loan capital raised at the close of the past half year. The former stood at £2,080,000 the latter at £725,000—together, £2,805,000. This was an increase of £30,000, as compared with Dec. 31, 1891; this amount of "C" stock having been raised in the six months.

Statements Nos. 3, 4, and 5.—the capital, revenue, and profit and loss accounts—are given in full on the opposite page.

Statements Nos. 6, 7, and 8 show the positions of the reserve, renewal, and insurance funds. The reserve fund stood at £44,219 13s. 7d., as compared with £54,808 12s. 6d. on Dec. 31 last (a sum of £17,021 being transferred to the profit and loss account); the renewal fund, at £9830 14s. 3d.; and the insurance fund, at £13,029 8s. 3d.

Statements Nos. 9 to 11—furnishing particulars as to the manufacturing operations of the Company—and No. 12, the general balance-sheet, are given in full.

BROMLEY GAS CONSUMERS' COMPANY.

Half-Yearly Report and Accounts.

The Directors' report and the accounts of this Company for the past half year have been issued. In the former, it is stated that the consumption of gas in the Company's district continues to increase at a very satisfactory rate; the sale during the last six months having been nearly 4 million cubic feet, or almost 5 per cent., in excess of that of the corresponding half of last year, and 16 millions over that of 1890; and this notwithstanding the comparative mildness of the present year. Owing, however, to the reduction in price by 3d. per 1000 cubic feet last year, and representing about £1000 in favour of the consumers in the half year, the actual money produced is less, while the cost of coal has been largely increased owing to the Durham strike, during which the contractors, availing themselves of the strike clause now inserted in all colliery contracts, suspended their deliveries, whereby the Directors were compelled to purchase large quantities of coal from the Yorkshire and Lancashire fields at 2s. 3d. to 3s. per ton in excess of the normal contract price. Notwithstanding the increased quantities dealt with, the receipts from coke and sulphate of ammonia are less by about £850 than in the corresponding period of last year; the loss being due to the unusually low prices which have prevailed for those commodities. There is also an exceptional item of expenditure under the head of compensation and law expenses, which, however, is not likely to recur. The result is that the revenue account shows a net profit of £4487; but the profit and loss account, including the undivided balance of last year, which was retained expressly to meet any deficiency arising from the reduction in the price of gas, shows a balance of £5075 to be dealt with by the shareholders. The causes which have diminished the profits are so exceptional, and the Company's prospects for the future—both as regards economy in working from improved appliances and the purchase and conveyance of coal under fresh contracts—are such that the Directors do not hesitate to recommend on the one hand an undiminished dividend, and on the other an adherence to the reduction in the price of gas, which appears to have given much satisfaction to the consumers; the present charge being, in fact, lower than that of the largest London Gas Company. It will therefore be proposed, at the forthcoming meeting of shareholders, that out of the balance of £5075 above mentioned, dividends be declared at the rate of 11½ per cent. per annum on the ordinary 10 per cent. shares, and 8½ per cent. on the ordinary 7 per cent. shares, amounting together to £5064. The Directors mention that they lately offered for sale by public tender 400 new shares, which were all taken up, and have produced the sum of £6166. Most of the alterations and enlargements for which this additional capital was required are either now completed, or in progress; and the Directors look forward with confidence to a fully satisfactory account for the current half year. With regard to the accounts, the receipts under the head of gas and meter rental came to £12,897; the amount produced by the residual products was £3933; and smaller items brought up the income to £17,020. The total expenditure was £12,533, of which £9826 was spent in producing gas. The balance carried to profit and loss account is £4487; and the amount of net profit at the credit of that account is £5075. As to the manufacturing operations, the quantity of coal carbonized was 8990 tons; and the gas made during the half year was 83,324,000 cubic feet.

Gas and Electric Lighting at Chesterfield.—Speaking upon th advisability of lighting the town by electricity at last Tuesday's meeting of the Chesterfield Town Council, the Mayor (Mr. J. M. Clayton) said he thought it was very desirable that they should go thoroughly into the question, particularly as they had such very bad gas. There was never a meeting of the Corporation but some member got up and complained of the gas, its poor quality and high price. He did not think they needed any better reasons for inquiring into the subject of electric lighting; and he hoped the members would see their way to appointing a Committee for the purpose. If they were to have an installation of electricity, he thought they, as a Corporation, should take the matter up, go in for a Provisional Order, and carry it out. They did not want an electric lighting monopoly in the town in the same way as they had a gas monopoly. He proposed that the Chairmen of the various Committees should constitute the Committee, with power to add to their number. This was seconded, and carried *nem. con.*

ACCOUNTS OF THE SOUTH METROPOLITAN GAS COMPANY FOR THE HALF YEAR ENDED JUNE 30, 1892.

No. 3.—CAPITAL ACCOUNT.

Dr. Cr.

	£ s. d.	£ s. d.
To Expenditure to Dec. 31, 1891	..	2,942,636 0 2
Expenditure during half year to June 30, 1892, viz.—		
New buildings and machinery in extension of works	54,180 6 0	
New and additional mains and services	8,295 0 11	
Do. meters	974 6 2	
Do. stoves	8,137 4 1	
		71,586 17 2
Total expenditure	..	3,014,222 17 4
Balance	..	153,631 2 8
		3,167,854 0 0

Description of Capital.	Certified to Dec. 31, 1891.	Received since that Date.	Total to June 30, 1892.
	£ s. d.	£	£ s. d.
By A stock	500,000 0 0	..	500,000 0 0
B stock	1,350,000 0 0	..	1,350,000 0 0
C stock	200,000 0 0	30,000	230,000 0 0
Debenture stock, 5 per cent.	725,000 0 0	..	725,000 0 0
	2,775,000 0 0	30,000	2,805,000 0 0
Premium capital	320,854 0 0	42,000	362,854 0 0
	3,095,854 0 0	72,000	3,167,854 0 0

No. 4.—REVENUE ACCOUNT.

Manufacture of gas—			
Coals into store, including cost of petroleum spirit for enriching. (See Account No. 9)	£231,908 3 8		
Purification, including £5236 19s. 5d. for labour	9,865 15 9		
Salaries of Engineer, Superintendent, and Officers at works	5,322 18 4		
Wages (carbonizing)	50,764 10 4		
Repairs and maintenance of works and plant, including £25,445 8s. 1d. for labour, less £1425 0s. 9d. received for old materials	42,755 19 10		
		£341,617 7 11	
To profit-sharing for twelve months to June 30, 1892		6,647 14 5	
Distribution of gas—			
Repair, maintenance, and renewal of mains and services, including labour £6572 5 2	£11,154 15 5		
Salaries and wages of Officers (including Rental Clerks)	8,854 17 8		
Repair and renewal of meters	5,032 10 0		
Do. stoves	2,005 19 6		
		27,048 2 7	
Public lamps—lighting and repairing		6,184 18 4	
Rents, rates, and taxes		16,357 18 11	
Management—			
Directors' allowance	£1,750 0 0		
Salaries of Secretary, Accountant, and Clerks	2,005 16 6		
Collectors	4,889 1 2		
Stationery and printing	1,063 19 4		
General charges	3,630 19 2		
Company's Auditors	112 10 0		
		13,452 6 2	
Law charges		204 15 0	
Bad debts		1,737 16 11	
Pensions and officers and men's superannuation and sick funds		3,803 12 2	
Gas Referees and Official Auditor		265 3 4	
Total expenditure		£417,319 16 3	
Balance carried to net revenue account (No. 5)		145,101 10 6	
		£562,421 6 9	

By Sale of gas—			
Common gas { Lady Day, at 2s. 6d. per 1000 feet	£247,855 14 7		
Common gas { Midsummer, at 2s. 6d. per 1000 feet	130,637 9 7		
	£378,493 4 2		
Public lighting and under contracts (see Statement No. 11)	29,705 15 9		
		£408,198 19 11	
Meters in use, 80,581—			
Company's meters at rent (65,994)	£7,766 15 10		
Stoves at rent (18,720)	4,264 6 11		
		12,031 2 9	
Residual products—			
Coke, less £13,570 12s. 6d. for labour, &c.	£89,642 7 2		
Breeze, less £1834 5s. 10d. for labour, &c.	1,697 2 9		
Tar, less £306 4s. 9d. for labour, &c.	27,201 13 3		
Ammoniacal liquor, less £209 15s. 3d. for labour, &c.	14,571 14 4		
Sulphate, less £2677 18s. 6d. acid, labour, &c.	7,544 11 3		
		140,657 8 9	
Rents receivable		1,469 10 4	
Transfer fees		64 5 0	
Total receipts		£562,421 6 9	

No. 5.—PROFIT AND LOSS (NET REVENUE) ACCOUNT.

Interest on temporary loan and deposits		£1,290 6 7	
,, debenture stock		17,671 17 6	
Balance applicable to dividend on the ordinary stock		126,362 6 10	
		£145,324 10 11	
Balance from last account		£115,728 18 6	
Reserve fund		17,021 1 6	
		£132,750 0 0	
Less dividend for the half year ended Dec. 31, 1891		132,750 0 0	
Amount from revenue account (No. 4)		£145,101 10 6	
Interest on Bankers' balances		223 0 5	
		£145,324 10 11	

No. 9.—STATEMENT OF COALS.

Description of Coal.	In Store, Dec. 31, 1891.	Received during the Half Year.	Carbonized during the Half Year.	Used during the Half Year.	In Store, June 30, 1892.
	Tons.	Tons.	Tons.	Tons.	Tons.
Newcastle coal	63,992	301,207	338,343	262	26,594
Cannel coal	2,158	957	1,303*	—	1,812
	66,150	302,164	339,646	262	28,406

* 154,545 gallons of petroleum spirit used as a substitute for cannel.

No. 10.—STATEMENT OF RESIDUAL PRODUCTS.

—	In Store, Dec. 31, 1891.	Made during Half Year.	Used in the Half Year.	Sold in the Half Year.	In Store, June 30, 1892.
Coke—cwt.†	561,814	4,080,465	864,002	3,636,828	91,454
Breeze—yards	13,352	63,748	12,153	59,977	4,970
Tar—gallons	561,155	3,314,950	23,060	3,128,925	724,120
Ammoniacal liquor—butts	14,674	115,332	33,856	84,038	12,112

† 1 cwt. of coke about equals 1 sack of 4 bushels, under Weights and Measures Act, 1878.

No. 11.—STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity made.	Quantity Sold.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
		Public Lights (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	3,429,303	210,048	3,051,412	3,261,460	42,872	3,304,332	124,971	18,843

No. 12.—BALANCE-SHEET.

To Capital—			
Balance—per account No. 3		£153,631 2 8	
Reserve fund—per account No. 6		44,219 13 7	
Renewal fund—per account No. 7		9,880 14 3	
Insurance fund—per account No. 8		13,029 8 3	
Net revenue account—for balance, per account No. 5		126,362 6 10	
Debenture interest for amount due to June 30, 1892		17,671 17 6	
Sundry tradesmen, for amount due for coals, stores, and sundries		40,354 6 8	
Deposits by consumers		26,477 3 3	
Dividend account (outstanding)		988 18 4	
Debenture account ,,		0 14 6	
Workmen's bonus and savings deposited with the Company		26,961 5 11	
		£459,527 11 9	
By Cash at Bankers			£101,152 0 11
Amount invested—			
Reserve fund	£43,367 15 8		
Renewal fund	9,562 1 1		
Insurance fund	12,715 6 3		
		65,645 3 0	
Cash in hand for sundry payments			500 0 0
Stores in hand—			
Coals and enriching materials	£21,499 5 4		
Coke and breeze	2,791 13 2		
Tar, sulphate, and ammoniacal liquor	8,980 6 8		
Sundry stores	74,992 10 3		
		108,263 15 5	
Investment of workmen's bonus, &c.		3,844 9 0	
Accounts due to the Company—			
Gas meter and stove rental, quarter ending June 30, 1892	£151,442 11 5		
Arrears outstanding	2,845 2 10		
		154,287 14 3	
Coke and other residual products		28,061 17 0	
Sundries		2,772 11 11	
		£459,527 11 9	

PROVINCIAL GAS AND WATER COMPANIES.

During the past few weeks, paragraphs have appeared in these columns giving the results of the working of several Provincial Gas and Water Companies; but as the financial statements and reports of meetings from which the particulars are extracted are now reaching us in greater numbers, they will be briefly noticed, in the next two or three issues, under the above general heading.

Gas Companies.

The half-yearly general meeting of the Barry and Cadoxton Gas and Water Company was held last Saturday. The report which was submitted showed that the undertaking was making satisfactory progress, and that the Directors were able to recommend a dividend at the rate of 5 per cent. per annum on the capital of 1886 and on the water stock of 1889, and a proportionate dividend on the gas stock of 1889. A contract, it was stated, had been entered into with Messrs. J. Aird and Son for covering in the low-level reservoir, and the work would be commenced forthwith. During the half year about 300 water services had been laid, 116 gas-services, 64 gas-meters fixed, and 40 new lamps. With reference to the application to Parliament in the last session for further powers, the Directors, acting under advice, decided to withdraw the Bill. The expenditure on capital account in the half year was £3772; bringing the total to £83,850. The estimated further expenditure during the six months ending Dec. 31 next is £5000. The revenue account showed a total income for the half year of £5079, and an expenditure of £3124. The interest on debentures absorbed £225, leaving a balance of £1729 available for the dividends.

The affairs of the Coatbridge Gas Company are in a prosperous condition. We learn from the report and accounts that the total income for the past six months was £7605, and the profits £1763, which, with the balance of £1589 brought from the previous half year, makes the sum of £3352 applicable for dividend. The unaccounted-for gas, it is stated in the report, was at the rate of 13·75 per cent.; and an average illuminating power of 26·59 candles was maintained. During the half year the mains have been enlarged in the Coatdyke and Calder districts, and extended to and in the village of Calderbank, at a cost for material of £1311 4s. 1d. The Calderbank Steel and Coal Company, Limited, have agreed to contribute £200 of this, leaving £1111, which, with £131 for meters supplied to new properties, has been charged to works' account. A large increase in the sales of gas is anticipated from this extension. The maximum dividends at the rate of 10 and 7 per cent. per annum on the old and new stocks respectively, less income-tax, have been declared; and the shareholders have given the Directors authority to borrow on mortgage or debenture the sum of £6000, to provide them with funds for the extensions which have been, and will require to be, made from year to year.

During the past half year, the Dorchester Gas Company have had an increase in the consumption of gas; but the continued rise in the price of coal, the Directors point out in their report, has naturally increased for the time the cost of production. To enable them, therefore, to recommend the payment of a dividend of 10 per cent. on the ordinary and 6 per cent. on the preference shares, they have transferred £200 from the reserve fund to the net revenue account. It appears from the statement of revenue that the total income from all sources has been £2997, of which the sale of gas yielded £2444; residual products, £529; and miscellaneous items, £24. The total expenditure came to £2156, of which sum the disbursements under the head of manufacture absorbed £1449. The profit for the half year was £841.

The shareholders of the Leatherhead Gas Company have recently held their ordinary general meeting, at which the Directors had again the pleasure of reporting a steady and substantial increase in the business. Considerable improvements and additions to the works, which were necessary for the successful conduct of the business, they stated, had been made during the past year under the superintendence of Mr. Frank Mead, of Sutton. To avoid the expense, &c., attendant on the creation of fresh capital, the Board decided to charge the entire cost of these works to revenue. This and the high price of coal had reduced the balance carried forward; but the Directors proposed the payment of a dividend at the same rate as last year—viz., 8s. per share, making a total of 8 per cent. on the year. On the improvements, a sum of £500 had been spent, of which £300 had been paid without increasing the capital; and the Directors said they felt confident they had consulted the prosperity of the Company by the course they had adopted. It was also mentioned that a contract for the supply of coal had been entered into on very much more favourable terms than those of the two preceding years. The Directors expressed deep regret at the death of Mr. T. Tomlin, one of the first promoters of the Company, who, as Director and Hon. Treasurer for upwards of 40 years, took a lively interest in its welfare. The report was adopted.

The Directors of the Malton Gas Company are able to report that the amount of gas sold in the past half year was 16,366,800 cubic feet, or 1,010,400 feet more than in the corresponding half of 1891; yielding an increased rental of £137. The balance available for division is £1660; and the Directors recommend the payment of a dividend at the rate of 10 per cent. per annum, free of income-tax. A contract for the supply of coal for the current year has been made on slightly more favourable terms than last year.

The half-yearly meeting of the Poole Gas Company, Limited, was held yesterday week. The report and accounts which were presented showed a balance of profit for the half year amounting to £1028, out of which the Directors recommended the payment of a dividend at the rate of 8 per cent. (free of income-tax) upon the "A" stock, and the maximum dividend of 4 per cent. (less income-tax) upon the "B" stock and "C" preference shares. The Board stated that plans for additional plant had been approved; and the work, so far as the erection of a new coal-store, was now in progress. This the Directors hoped soon to have finished, so as to enable them to get in a good stock of coal while freights were low for the next winter. The revenue account showed a total income of £2943, of which £2365 was for gas, £520 for residual products, and £57 for minor items. The manufacturing expenses amounted to £1450, and distribution, management, and miscellaneous outlay brought up the total expenditure to £1914—the balance being £1028. The amount of net profit to be carried forward, subject to the half-year's dividend, was £3216.

The accounts of the Scarborough Gas Company show a profit on the past half-year's working of £4810. The net revenue (including £1905 brought from the previous accounts, and after deducting all interest charges for the half year) is £6284. Out of this sum, after providing for the dividend on the preference stock, the Directors recommend the payment of the statutory dividends on all other stocks of the Company. The payment of these dividends will absorb the sum of £5141, and leave a balance of £1143 to be carried forward. The Directors have the pleasure of reporting a large increase in the consumption of gas during the half year, which has, to a considerable extent, compensated for the loss of revenue due to the present reduced price. The cost of coal, however, is still high; and the value of tar and ammoniacal liquor has materially fallen. There continues to be a good demand for cooking-stoves and other gas appliances; the increase in this branch being in excess of previous periods.

The result of last half-year's working of the Weymouth Consumers' Gas Company, taking into account the serious drop in the value of residual products, compares favourably with preceding periods. The balance of profit, after providing for the interest on the debenture bonds, allows the declaration of the maximum dividends for the half year upon both the stock and share capital—viz., 10 per cent. per annum on the ordinary "A" stock and 7 per cent. per annum on the ordinary shares, subject to deduction for income-tax. A new trunk main has been completed, and enables the Company to provide an adequate supply of gas to the whole of their district. Turning to the accounts, it is seen that the income amounted to £5826, which sum was divided as follows: Sale of gas and meter rental, £4716; residual products, £940; gas-fittings, £166; and transfer fees, £2. The manufacture of gas cost £2940, and other items brought up the total expenditure to £3827; so that there is a profit balance of £1998. The sum standing to the credit of net revenue account is £2671. The report and accounts were adopted at the shareholders' meeting last Thursday.

Water Companies.

The revenue account of the Camborne Water Company for the past half year shows a disposable balance of £935, out of which dividends have been declared at the rate of 8 per cent. per annum on the "A" shares, and £5 12s. per cent. on the "B" shares (both free of income-tax).

By the aid of £197 taken from the balance brought forward from the preceding half year, the Directors of the Cambridge Water Company are able to pay a dividend for the six months ending July 6 last on the consolidated stock at the rate of 10 per cent. per annum, and on the amount paid on the new shares at the rate of 7 per cent. per annum.

The accounts presented at the half-yearly meeting of the Chester Water Company last Thursday week showed a surplus of revenue over expenditure of £3110, which, added to a balance of £3523 from the previous half year, made £6634. The interest on preference capital required £450, which left a balance of £6184. Resolutions were carried, declaring dividends, without deduction for income-tax, of 7½ per cent. per annum, upon the consolidated stock, 6 per cent. on the perpetual 6 per cent. preference shares, 7 per cent. upon the amount paid and entitled to dividend on the new ordinary stock (1874), and interest at the rate of 4 per cent. on the amount of calls paid in advance on the second moiety of the new stock. The dividends required £1890; leaving £4294 to be carried forward.

The Directors of the Consett Water Company, in their last report, express regret that, owing to the prolonged strike in the coal trade, the mechanical rentals show a decrease of £965. The domestic rentals, however, exhibit a gratifying increase of £129, as compared with the corresponding period of last year. After paying the interest on bonds, income-tax, and management expenses, there remains an undivided profit of £5311, out of which the Directors recommend the payment of a dividend at the rate of 6 per cent. per annum, which will absorb £5069. The statement of accounts shows that the total income from all sources during the six months was £7802, and the expenditure £1588; the balance on profit and loss account being £6214.

The Directors of the South Staffordshire Water Company are able to report a good increase in business during the past half year; the number of houses laid on being 1291—making the total supplied 76,515. The gross amount of water-rates for the six months was £39,028, as against £37,165 in the corresponding period of the previous year. After providing for interest on the debenture and preference stocks, the amount remaining for division (including £3522 brought from the previous half year) is £18,960; and the Directors recommend the declaration of a dividend on the ordinary stock of 5¾ per cent. per annum, less income-tax. The amount of this dividend being £15,417 3s. 9d., there will remain £3543 8s. 11d. to the credit of next half year.

In their annual report to the shareholders, the Directors of the Wrexham Water Company state that the expenditure on capital account during the past year has amounted to £3258. The receipts upon water and fittings accounts for the year show a slight decrease; but this was in consequence of the exceptionally large sales of water by meter in 1891 not having been maintained. After payment of the usual charges, the dividends on the preference shares and stock, the interim dividend of 5¾ per cent. for the half year ending December, 1891, and interest on mortgages for the year, a balance remains on net revenue account of £3491. The Directors accordingly recommend the declaration of the second half-year's dividends, at the rates of 5¾, 5, 4¾, and 4 per cent. on the various classes of shares and stock. During the year water has been laid on to 213 houses; making a total of 4124 houses now supplied. The report concludes by referring to the overtures which were recently made by the Wrexham Corporation, with a view of entering into negotiations for the purchase of the Company's undertaking by the Local Authority. The Directors state that, having given the matter their careful consideration, they have arrived at the conclusion that it is not expedient to enter into any negotiations, nor to entertain proposals for the sale of the works; and this decision has been conveyed to the Corporation.

The half-yearly meeting of the York New Water Company was held last Thursday week. In moving the adoption of the report, the Chairman (Mr. J. F. Taylor) said it was a matter for congratulation that their revenue continued to increase steadily half year by half year.

Alluding to the amended Bradford Corporation (Nidd) Water Act, 1890, he said that, by friendly negotiation, the amendments considered necessary in the interests of the Company had been embodied in the Act as passed. They trusted that the Act would not interfere with the supply of water of York, which at present was abundant and of good quality. Sir J. Terry seconded the motion, which was carried *nem. con.* Subsequently a dividend of 5s. per share on the preference shares, being at the rate of 5 per cent. per annum, a dividend of 9s. per share on the ordinary shares, being at the rate of 9 per cent., and a dividend of 6s. 3d. per share on the new shares, 1878 and 1879, being at the rate of 6¼ per cent., was declared.

GLASGOW CORPORATION GAS SUPPLY.

The Annual Report and Accounts,

At the Meeting of the Glasgow Town Council last Thursday—Bailie J. H. MARTIN presiding—the report of the Gas Committee (which was summarized in the JOURNAL last week) was submitted.

Bailie MITCHELL, in moving the adoption of the report, said he was sorry the balance-sheet brought out a somewhat different result from that to which they had been accustomed, and showed, instead of a substantial profit, a somewhat serious loss on the working of the financial year ending on May 31 last. The Committee had hoped that, although on May 31, 1891, only a very small amount remained to the good, they might have gone on for another year without any material loss, and still supply gas to the public at 2s. 6d. per 1000 cubic feet. But unfortunately their hopes had not been realized; and they were now faced with a deficit of £27,116, and were reluctantly compelled to recommend an advance of 3d. per 1000 cubic feet—making the price 2s. 9d. for the current year. It was not pleasant to make such a proposition after so many steady reductions from 5s. 5d. in 1874 to the present rate; but the Council must not forget that the price proposed to be charged was still very low—indeed he believed it was the lowest in Scotland. The reasons for this loss were fully mentioned in the report, and were such as must affect every trading concern from time to time. The coal market had been against them to the extent of 8d., or ¾d. per 1000 cubic feet of gas made; and, on the other hand, the fall in residual products, on which so much of their revenue depended, had during the past year further increased the net cost of manufacture to 2·05d. per 1000 cubic feet, which had been, however, reduced 0·71d. by a saving on the other items of expenditure, leaving a net increase of about 1·3d. per 1000 cubic feet of gas made—these items together accounting for the deficiency in the balance-sheet now before them. It might be asked why the Committee proposed to increase the price of gas by a sum which should produce about £45,000, to meet a loss of only £27,000; but this was explained by the fact that, although, judging from the purchases made and the present aspect of the coal market, the price of coal would probably be about 1s. per ton less this year than last, the value of residuals had fallen still further since May last, and would, they feared, more than absorb the expected saving on coal. With the rate of gas therefore continued at 2s. 6d. per 1000 feet, the Committee would, at the end of the current year, be face to face with a further deficit similar to the present. They, on that account, recommended that the loss for 1891-92 should be wiped out during the current year; and, with the proposed advance in price, they hoped no further loss would accrue. Should more favourable results, however, be obtained, they would be only too glad to be able to relieve consumers by a reduction in price as soon as possible. He might be allowed to state that the works and plant as usual, during the past year, had been maintained in a state of efficiency. The consumption last year, apart from the production of the newly-acquired works, had increased fully 6 per cent.; and with their greater facilities of output and storeage, the Committee would be able to cope satisfactorily with even a still greater demand, which, judging from past experience, might with confidence be predicted. They had no reason whatever to doubt that the prosperity of the Trust would be maintained and even increased in future years, as in the past. The present unfavourable result, they were glad to say, was entirely exceptional.

Mr. CHISHOLM, in seconding the motion, remarked that the members of the Committee shared with the Council the regret at the necessity for recommending an increase in the price of gas. He might also say that, while the works had been maintained in the very highest state of efficiency, they had only written off 1 per cent. for depreciation during the past year. This was doubtless quite enough to write off in the high efficiency at which the works were kept, yet it was not equal to the amount that had been written off in former years. The deficiency was at the present moment reduced to the very smallest minimum; but if they were to continue for another year on the same basis on which they had proceeded during the past year, the deficiency, instead of being £27,000, would be £54,000. Raising the price of gas by 3d. would give them £45,000; and, if circumstances should prove favourable, he believed there would be a small balance on the right side at the close of the year.

Preceptor WADDELL congratulated the Gas Committee on the report they had been able to present.

Mr. URE fully expected that the report of the Gas Committee would have been subjected to criticism, instead of congratulation. Perhaps the Council were entitled to a little more information than they had really obtained. The Committee had spent very largely on capital account during the past two or three years; and the question came to be whether they had anything to show for it. They had constructed entirely the South Side works, and had added to the different works; and the question was whether the money so spent had been to the advantage of the community. This had struck him very forcibly. There were certain things which were entirely beyond their control, which necessitated a rise in the price of gas. He had careful figures drawn up in order to answer all inquiries; and, although he would not go into detail, he would give the result. He found that in manufacture, exclusive of coal, they had saved during the past year, as compared with the previous year, the sum of £10,847. This was one of the effects they had from the improved system of working; and, as the improved appliances were not yet completed, they were not wholly available. Then the expense of distribution, and rents, taxes, management, and law was £8484 less than that of the previous year. He hoped that this was satisfactory to the Council.

Mr. DICKSON said he was delighted with the report of the Gas Committee, considering the very exceptional period they had been passing through during the last two years.

Mr. BATTERSBY stated, in answer to several inquiries which had been addressed to him, that a sum of about £34,000 had recently been paid away for perpetual annuities, some of 9 per cent., and others of 6¾ per cent. It was well, he thought, that the public should understand that the Trust was compelled to pay this large amount. The cost of each £100 share was £296.

The report was adopted.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Tuesday, July 26.

(*Lord* BALFOUR OF BURLEIGH, *Chairman; Sir* G. B. BRUCE, *Sir* A. GEIKIE, F.R.S., *Professor* DEWAR, F.R.S., *Mr.* G. H. HILL, M.Inst.C.E., *Mr.* J. MANSERGH, M.Inst.C.E., *and Dr.* W. OGLE, *Commissioners.*)

The following additional evidence was given to-day:—

Mr. *F. A. W. Drummond*, an assistant to Lieutenant Bell, was questioned particularly with regard to pollutions at Staines. He stated that these were not quite so bad as formerly, but that they still existed—intermittently at some of the discharges, and constantly at others. The place had been inspected every fortnight for the last ten years, and reports made upon it, very often day after day.

Mr. HILL: Is the time at your disposal in the district under your charge sufficient for a thorough inspection of the whole of the populated places?

Witness: I am afraid not; we have so many other duties—the river duties—which interfere with regular inspection.

Professor DEWAR: Have the Conservators taken any action themselves with regard to these pollutions at Staines?

Witness: Yes; they have served notices in 121 cases in Staines.

And what has been the result of these services?—In some cases, either occupiers or owners—I can hardly say which—have complied with the notices, and cut the connections.

And these are cases in which you require, before you can take any action, to give notice?—Yes; 13 months' notice.

Mr. *C. J. More*, Engineer to the Thames Conservancy, also recalled, submitted plans and diagrams showing the volume of discharge at Teddington and the rainfall in the Thames Valley for the period from 1883 down to the present time; and also sections and drawings of the Teddington Weir.

The CHAIRMAN specially thanked Mr. More for the trouble he had taken. He added: Can you say, from your own knowledge, how many days elapsed from the time of maximum rainfall to the time of maximum discharge at Teddington Weir?

Witness: That would depend a good deal upon the season and the condition of the land when the rain fell. For example, half-an-inch of rain in June, when the ground is dry, would not have much effect; while a similar quantity at a time when the ground is saturated with previous rain would have an almost immediate effect at the weir.

Could you put the time into hours?—In the same day, I should say.

The case of the Middlesex County Council was next taken.

Mr. *Littler*, Q.C., Chairman of the County Council and of the Quarter Sessions of Middlesex, and Deputy-Lieutenant of the county, appeared as a witness on behalf of the Middlesex County Council for the purpose of the inquiry, and directed attention to a statement he had sent in.

The CHAIRMAN observed that some of the points dealt with were scarcely within the terms of the reference to the Commission. At the same time, he sympathized with Mr. Littler in putting them all in.

Witness stated that the administrative area of the County Council of Middlesex had a population of 560,318; and the valuation which formed the basis of the last county rate was £3,108,633—a considerable increase on what it was at the time of the division of the old county. Then, for the purpose of his evidence, he divided the county into two zones—the urban and the rural. In point of fact, Middlesex absolutely surrounded the county of London on the north side; and that nearest London was naturally the urban zone, and the one farther away was what they defined as the rural zone. What they had really taken for the urban division would be, starting from the eastward, Tottenham, the inner portion of Hornsey, the inner portion of Hendon and Willesden, and then, passing farther westward, Acton, Ealing, and Brentford.

The CHAIRMAN: But what is the line you have taken—the line that is built over, or a simple circle drawn from a centre?

Witness: No; it is taking the parts which are mainly built upon. Where there is a defined district, such as an urban local board district or an urban district, if the whole of it is supplied by one of the London Water Companies, we have taken the whole, although perhaps some part of it might not be so closely built upon as the other. We have in no case taken a district which was anything like continuous cornfields as urban.

Why should you divide it into two zones at all? Is it not sufficient for your purpose to say, as you do, that the whole of your district, being immediately contiguous to the Metropolis, is affected by the growth of population in the Metropolis?—Probably that would be sufficient for the purpose. I think we may say what we have called the inner zone is almost entirely supplied by the London Water Companies, with the exception of Tottenham. Perhaps that is what has been more in our minds than anything else.

Is any part of the area administered by the Middlesex County Council outside the parliamentary district of the Companies?—Yes

Witness proceeded to illustrate this; and mentioned that his Council did not pass to the south of the Thames at any point. The Companies supplying water within his county were the Grand Junction, the West

Middlesex, the New River, and the East London. Except for the places within their areas of supply, his county was served by local companies and authorities, or by independent private supplies. He put in a table showing the districts of the county served by the four Water Companies he had named. Dealing with the population, he pointed out that the conclusion to be drawn from the statements was that they found that, out of a total of 560,318 people, the London Companies supplied 364,300 last year, as against 230,490 in 1881; being an increase of 133,810. The object of that was to show how largely they were interested in whatever might be the fate of the Companies, and in the general question of the water supply. Another table put in would furnish further explanations—the urban and rural sanitary districts in the administrative county of Middlesex supplied with water locally, either by local companies, from wells, or by the local authority.

The CHAIRMAN: You have no means of telling what water they used?

Witness: I think that would be very difficult indeed.

We are trying to get at it, but we find considerable difficulties in the way; and we wanted to know whether you could help us?—I have tried very hard, and I do not think I can give you anything which is reliable at all.

Witness proceeded to say that, to summarize the table, the effect of it was that in 1891 the population which was not supplied by the Water Companies—that was the shortest way of putting it—was 196,288, as against 136,493 in 1881, which was an increase of about 45 per cent. Of course, the district supplied had been increasing very much more rapidly in population than the district not supplied. But now the rest of the county was more or less getting filled up; and in the future the increase would be more rapid in what he had called the outer zone than in the inner one. This, he thought, was material to the inquiry, because it showed that their anxiety to protect the outer portion of the district was one which was justified by an increasing probability of the demand being larger.

The CHAIRMAN: Have you put in any estimate of what will be the probable increase in population, or the probable wants of that population which is outside the district that is within the parliamentary area of the Companies? I ask the question for this reason—that within that area the Companies can be asked to supply; but outside the same pressure cannot be brought upon them.—That is so. I should think (this is an estimate, but it is one which is arrived at after having thought about the matter) that of this 45 per cent., which has been the increase between 1881 and 1891, certainly more than two-thirds is due to the last five years. It is still continuing; and I should think that the population will certainly double within the next 15 years. That is as near an estimate as I can give from knowing what is going on in different parts of the county. I should think in 15 years that which is now 196,000 would probably be very close upon 400,000.

And the responsibility for supplying all that population will devolve, in your opinion, either upon the local companies or upon the local authorities in that district?—Quite so.

Has there, in your experience, been any attempt on the part of the Water Companies to extend their possible area of supply into your administrative county?—Certainly none of the London Companies have made any.

I see a general statement in what you put before us that "from these tables it becomes very clear that the county of Middlesex is largely interested in seeing that the existing supply of the Companies is not alienated, and in keeping the unappropriated water supplies of the county for the future requirements of its large and increasing population." What do you mean by the "unappropriated water supplies of the county?"—What I mean is that nearly the whole of Middlesex has water under it within a reachable distance. We have a very large quantity of water under the county, if we can only protect it.

But the Water Companies are supplying 364,000 of the population out of 560,000, are they not?—They are.

And not from water which is exclusively the property of your county?—They supply partly by pumping, partly from the River Lea, and partly from the Thames; and, certainly, so far as the Thames is concerned, before it reaches London at all—in fact, places where some of the intakes are—it is absolutely in the county of Middlesex. It must come to Middlesex, of course, before it gets to London.

If we were to go into a debtor and creditor account, as between the population of Middlesex and the Water Companies, the latter would be able to say, would they not, that they are supplying 364,000 of your population, mainly from a source of supply which is, at any rate, to put it not too high, not exclusively the property of Middlesex?—I can scarcely tell what proportion of the water which supplies the northern district of the New River is actually pumped within it; but I strongly suspect they pump more water there than is supplied there.

In the course of further examination, mention was made by the Chairman of the fact that the West Middlesex and Grand Junction Companies are practically exclusively supplied by the Thames; and on the witness adding, "and from one very important source—from gravel beds in our county, from which they pump"—he was asked if he knew the circumstances of those beds. He replied that it was very difficult to ascertain exactly what the circumstances were; but they knew that there were in the immediate neighbourhood of the River Thames very large gravel beds which certainly some engineers were strongly of opinion were rather feeders of the river than fed from it. His belief was that those beds had an independent source of supply, supposing all water which entered them from the Thames were cut off. This belief was founded more on information obtained, which he admitted was not perfect. People, for instance, told them that they did not find any increase or decrease of the Thames had very much effect upon their wells. In summer and winter there was a very marked disproportion in the flow of the river; and people whose wells were adjacent told them that many of them found those wells not at all the worse in summer, with the lowest water in the river, than in winter, and that the high water in the river did not seem to increase the flow into their wells. All this indicated a considerable, if not entire independence of the sources of the wells. Referring further to paragraphs of the statement he had sent in, witness directed attention to the experience mentioned, that he and others found that there was a reduction of the supplies in various parts of the county, and that they had great complaints of damage caused by the decrease of water. He thought this would increase in the future—first, because of the growth of population; and next, because the county was a very undulating one, and as the work of making sewers was continued throughout the county, there was necessarily a great loss of water. These circumstances made it the more important that all the water they could get should be protected. Where the sewers had been cut, they ran through long beds of gravel; and where they did not, they had been cut through the clay, and had, as it were, spoiled the basin. The water ran alongside, and flowed away; and some of those who before had excellent supplies could not now get a drop. If a well were only sunk as far as the bottom of the gravel, and the sewer were laid on the clay at the bottom of the gravel, the effect would be to drain the gravel. This would not touch the point upon which so much stress had been laid, of depletion of water by pumping from the chalk. He did not profess to say anything on the chalk point; but he did know that the Tottenham Local Board, of which he was at one time Chairman; had had continual trouble in the matter of a water supply, and had been constantly obliged to go lower down into the chalk. He believed that at that moment they were in difficulty about getting low enough. Reverting to the main point, witness mentioned that supplies of water which could be interfered with by the laying of sewers as he had described, would be in no sense public ones, but those of individual persons in respect of their own premises. A very large portion of Middlesex was so served at the present time. There was no public supply, and none would have been needed for the whole of the district, had it not been for the works of sewering; and therefore he said, when they got into another new district, and must have sewers as it became urban instead of rural, they disturbed the portion of the supply of which he had been speaking, and all they had to fall back upon was the chalk. The Commission would hear from others what was likely to be the effect in Middlesex upon the chalk; and they would see why it was that in that county the inhabitants were most anxious to protect every drop of water they could. Another point that was causing them a great deal of anxiety was this: There was a proposal which was seen in its strongest form in the action of a gentleman who was sinking wells and proposing to sell, if he could, to the London Water Companies or to anybody else, 10,000,000 gallons of water per day. It was an arguable question whether or not this gentleman had any right to the water, because there was no property in underground water; and therefore possibly nobody could prevent him selling it. But if this sort of thing were to go on, either by the action of the Water Companies, or, still worse, by that of unregulated individuals against whom they could not claim that they should supply a district, it would be a very serious thing indeed for the county. If a person bought a field in a certain position of the strata, and could there pump water to an unlimited extent, he might deplete the whole district.

The CHAIRMAN said he believed the bearing of the case mentioned was rather outside the reference to the Commission; but it might be taken into consideration, although he should not like to raise a controversy about it.

In answer to a question as to what he meant by the suggestion that it would shortly be necessary that some of the water now taken by London should be retained for local use in Middlesex, witness said that, inasmuch as they in Middlesex were locally above London, and as London also availed itself of Middlesex for the purpose of its intakes and its reservoirs, and so on, they thought that, although they were much smaller, they had certainly the right to claim that, if water was drawn from the Thames, they should have, not the first drink, but, at all events, as much in proportion from the Thames as London took.

The CHAIRMAN: Do you mean that, because some point of your administrative county touches the bank of the Thames above any point of the administrative county of the County Council of London, therefore the whole of Middlesex has a prior right to the Thames?

Witness: No; I do not say we have a prior right; but I say that whatever water is taken we should have, at all events, the same proportion of water as our area bears to the area of London. Because London is bigger, it should not say: "Oh, no; we must have all the water, and leave you to get water where you please;" but that, so far as there is water available from the Thames, we ought to have, in proportion to our area, the same right of draught upon it as London.

In reply to Mr. HILL, witness explained that, when he spoke of the preservation of water in his own county, he referred to the sinking of wells in districts beyond that county. He feared that water abstracted from deep wells, even although they might not be in his own county, would affect the supply in that county if they were higher up in the vicinity.

Dr. OGLE questioned the witness as to the equitable division of water between London and Middlesex of which he had spoken, and asked if it ought not to be taken into account that a very large proportion of the inhabitants of Middlesex, outside of London, came into the Metropolis for the whole day, and that a great deal of the water that was consumed there was really not consumed for the inhabitants, but for those of neighbouring counties.

Witness replied that this might affect the proportion; but still he took it that the greater part of the water which was used, at all events for domestic purposes, was consumed where the people's households were, rather than in places to which they went.

In reply to Sir A. GEIKIE, witness added that the local wells that were drained, to which he had referred, were all in the gravel; and as to what had become of the water tapped by the system of sewering he had described, he observed that a very large proportion of water was conveyed away by the sewers. Even now they carried off a great deal of water; but they were very badly laid originally, and for a very long time they ran full of clear water. The new Local Board had relaid a considerable number of them. But a large proportion of the water still ran alongside the pipes, where they passed through clay; and it found its way into the pot-holes and eventually down into the Lea, or some of its branches. It passed off wherever the strata would permit.

Mr. *W. Kitteringham*, Surveyor to the Enfield Urban Sanitary Authority, was the next witness called. He stated that the area of his district was 12,608 acres; and the population 18,944 in 1881, and at the last census 31,799. In the immediate future, they might expect a

material increase, as at present about 2000 acres of land were laid out for building purposes, and large portions were built upon. Witness gave it as his opinion that there was an undoubted connection between the wells of the District Board and the New River Company's well at Hoe Lane, 1½ miles away, for when the pumps at this place were at work, the influx of water to the Board's wells was distinctly slower than at other times. This was very marked during the sinking of a new well by the Board. Further, the water-level at the Eagle House well (the Board's) had for a long time been getting gradually lower, and was still falling. There was no evidence that the Board's wells depleted one another, although two of them were only about half-a- mile apart.

The CHAIRMAN: Is the inference you draw that the New River Company ought not to be allowed to pump; or that there is a certain supply of water in the chalk, and if more than this supply is taken, everybody will suffer?

Witness: If they have permission now to extend their works by sinking new wells, our district must suffer.

What I want to get from you is this: Is nobody to have a new well except your Local Board, or do you think that the maximum that the district can supply at the present time has been reached?—That is my opinion; and having regard to the obligations of our Board, and the magnitude of their district, it will be a very serious thing if this goes on. We are bound to supply our district with water, from some means or another, when application is made to us.

But how far away from your district do you think nobody else should put down a well?—The East London Water Company possess a piece of ground which is within 50 yards of our well; and if they have a legal right to sink at that point, there is nothing to prevent them taking our supply by making their wells deeper, and so deprive our whole district of water.

In other words, you agree with Mr. Littler in deprecating the struggle of one body against another for a supply, which, at the most, should be divided over the whole district having a right to it?—I do.

In reply to Mr. HILL, witness remarked that the sinking of further wells in his district would not affect the surface waters, because the chalk lay 100 feet below the top of the ground.

Mr. *T. Spencer Tilley*, of 15, Walbrook, E.C., a well engineer and water-works contractor, was next called. He testified to having had considerable experience in the sinking of wells in Enfield and the immediate locality; and stated that, under instructions from the Enfield Local Board, he had recently been making a new well to a depth of 300 feet at Ponders End. In sinking this well and driving adits to the depth of between 100 and 200 feet, there was a yield of 400 gallons of water per minute during the daytime; but from 2 a.m. to 8 a.m., it was increased by 80 to 100 gallons per minute. Asked how he accounted for this, he stated that they had to run their pumps four strokes faster, which would give from 80 to 100 gallons per minute over the gauging-boards. The only way in which he could account for this was that in the early morning the New River Company were not pumping. He did not know it as a fact that they were not doing so; he only assumed it. He, however, had another circumstance which strengthened him in his opinion. In June, 1891, between 12 a.m. and 3 p.m., the water for a short time came in milky; and he could only suppose that the cause of this was that the New River Company had stopped pumping, and had allowed the water to rise in the well. He could only assume that the water had risen in the Hoe Lane well, that there was a connection between the two wells, and, the head of water in the Hoe Lane well being in direct communication, the water was flowing from it into the Local Board's well, and, coming to a fissure, was clearing that fissure of chalk. Witness went on to affirm that within the limits in which he had sunk wells in the neighbourhood in question—which was as far as Enfield Lock, down by the Lea, Cheshunt, the Edmonton Union, and round about there—the level of saturation had been lowered in recent years, and the water-level of the wells had been steadily falling.

Mr. *J. Mercer*, landowner, brewer, and formerly a millowner on the stream known as the Fray's, near Uxbridge, was the last witness called. He said he had had long experience as a millowner, and had made personal observations extending over many years, from which he was able to speak of the flow from time to time of the Colne; and he stated that this stream had diminished in volume 20 per cent. in the last 20 years. The normal flow now was 1¼ in. below that of 1867.

The CHAIRMAN: Over how much surface, and how many million gallons a day does that amount to?

Witness said 6½ inches over 99 feet, which was the breadth of the combined river, would mean about 76 million gallons in 24 hours. He then proceeded to state that he had some instances of decreased power in mills, diminished flow of natural springs, and lowering of water-levels in artesian wells, in the district of which he was speaking, which caused him to estimate the falling off of the water at 20 per cent.; and he connected that loss with the sinking of wells up the Colne Valley by the Colne Valley Water Company. The falling off which he said he had observed in the Colne, he attributed to the deep borings of the different water companies and private individuals through the chalk area. He had himself noticed that the water in the deep chalk pits around had gradually become lower, and the chalk was whiter in appearance than it used to be; showing that it was getting drier. It was, in fact, a question with them now as to how they were to supply with water anything like an increase in the population of their district, or even the population they now had. The volume of water they were enabled to pump had fallen off to such an extent that they were pinched. It was easier for them to deplete their supply than formerly; and he attributed this to a reduction of water through the water-bearing strata, owing to increasing pumping outside of them. As deeper wells had been sunk around and about them, the decrease had gradually gone on. Finally, he invited the Commission to bear in mind that any abstraction of water from the chalk system throughout the counties of Hertfordshire and Buckinghamshire, and the district round about, would be very detrimental to owners of property on the Colne and its tributaries, and might eventually seriously affect London itself, inasmuch as the Colne was a tributary of the Thames. He added that it had been estimated that the value of the mills in the Colne Valley was about £800,000.

The inquiry was adjourned till the following day.

THE MORLEY AND BRADFORD CORPORATIONS AND THE WATER SUPPLY OF GILDERSOME.

On Wednesday week, the 3rd inst., an inquiry was commenced at Gildersome, by Colonel J. O. Hasted, R.E., into an application made to the Local Government Board by the Morley Corporation for sanction to supply the Local Board district of Gildersome with water. Mr. Balfour Browne, Q.C., in opening the case for Morley, said the circumstances were such that his clients had an ample supply of water to sell to Gildersome. It was excellent in quality; while that of Bradford, which Bradford wished to force down the throats of the people of Gildersome, was open to serious objection, inasmuch as it had a very detrimental action upon lead pipes. Mr. J. B. Brereton (the Medical Officer of Health for Gildersome) said he had attended many cases of lead-poisoning caused by the Bradford water supply; and some of his patients would be affected all their lives. He did not know of one instance of lead-poisoning from the Morley supply. Mr. J. Ellis (Clerk of the Gildersome Local Board) and Mr. P. H. Booth, cloth manufacturer, gave evidence as to the dissatisfaction caused by the Bradford supply, and the improvement in the health of the township through the use of the Morley water. The witnesses were cross-examined at length by Mr. Wills. This concluded the case for Morley; and the Inspector adjourned the inquiry till the following Monday, when the proceedings were, by arrangement, continued in the Metropolis. Mr. James Watson, Engineer to the Bradford Corporation, gave evidence as to the sources of supply of the Bradford water and its quality; stating that, if there was any dirtiness in it on arrival at Gildersome, it was owing to their own neglect. The price at which Gildersome received the water was 9d. per 1000 gallons; the cost of it to the Bradford Corporation being a fraction over 8½d. A plan had been submitted to the Corporation by which Gildersome should be supplied direct from Bradford, instead of through Drighlington, by a separate main, the cost of which would be £1500, and the interest on which would be paid by Bradford, so that there would be no profit left. Mr. W. T. M'Gowen, Town Clerk of Bradford, spoke as to the circumstances under which, in 1868, Gildersome and Drighlington were brought within the Bradford area at their own request; and as to the amount that had been expended by the Bradford Corporation in providing works for the supply of themselves and twenty-nine out-townships. If the out-townships were withdrawn from the supply area, it would, he said, be a serious thing for Bradford, as they would be called upon to meet the whole of the debt which had been incurred at the instance of its neighbours, to assist them in times of great difficulty on the water question. When the Morley Bill was before the House, he received assurances from Mr. Gott, the Engineer, that they did not intend to invade the Bradford district; and it was in consequence of these assurances that they did not oppose the Bill. Mr. Balfour Browne said that Mr. Gott's assurances would be of no avail whatever, as whether the Morley Corporation had a right to supply Gildersome would entirely depend upon the construction of their Act of Parliament. Dr. T. W. Hime, of Bradford, having been called, the Inspector decided that he could not receive evidence to show that the Morley water was not as good as Bradford, and could not go into a comparison of the two waters; but as to the allegation that the Morley water was unwholesome, if the Corporation were prepared to dispute the analysis that had been put in, he would hear evidence. Mr. Shiress Will protested against this decision, stating that this was not hearing all the circumstances of the case; and he gave notice that application would be made to the Local Government Board with a view of obtaining a full inquiry. Dr. Hime, proceeding with his evidence, said that although the Morley water when taken from the moors was pure, it was highly dangerous owing to its action on lead; and this was confirmed by Professor Dewar, who spoke favourably of the process adopted at Sheffield and Bradford to remove danger from this cause. Mr. Furniss, Clerk to the Drighlington Local Board, offered evidence as to the circumstances under which the arrangement was entered into in 1868 for that district and Gildersome to take water from Bradford. Mr. Shiress Will, Mr. Freeman, and Mr. Balfour Browne then addressed the Inspector on the whole case, after which the inquiry terminated.

At the meeting of the Bradford Town Council last Tuesday, Alderman Smith Feather, referring to the above inquiry, pointed out that, while the Inspector refused to take evidence to prove that the Bradford water was good and wholesome, he received evidence from the Morley Corporation respecting the quality of their water. The Water Committee felt it was desirable they should enter a protest against this action. The President of the Local Government Board promised, before the inquiry took place, that the Bradford Corporation should be heard; and he thought they should take steps to get the case re-heard, if possible. He then moved a resolution, asking the President of the Local Government Board not to make any Order upon the representation of the recent inquiry, and empowering the Committee to take what steps they considered proper. The motion was carried.

The Public Lighting of Clonmel.—The question of the public lighting of Clonmel was considered at a special meeting of the Town Council held last Thursday. A letter was read from the Gas Company offering to light the city at a uniform rate of £2 17s. 6d. per lamp, as proposed by some of the members at the previous meeting. A letter from the Electric Light Company was also read, saying they were agreeable to light the city for a further period of six months at the same rate as before, and that they would be willing to light the city for five years if the Corporation would lay the mains and wires underground, as required by the Board of Trade—the Company to pay the rental on the wires. After a long discussion, the Corporation determined to accept the tender of the Gas Company, and to allow the idea to light the city altogether with oil, which had been brought forward, to die out. Since this decision was come to by the Corporation, we understand that the Electric Light Company have offered to sell their plant to the Corporation for £5500, and to undertake, in the event of the Corporation purchasing, to work it for £1200 per annum. It remains a question whether the Corporation could legally, and, with a fair prospect of success, entertain this offer.

LEEDS CORPORATION WATER-WORKS.

The members of the Corporation of Leeds recently made their annual inspection of the works which supply the borough with water. They first visited the Arthington Station, which is used as an auxiliary to the gravitation supply which is obtained from the Washburn Valley. The Corporation have power to take 6 million gallons per day from the foot of the Washburn; and the water is led in a 27-inch main to the pumps at Arthington, which force the water to a height of 260 feet to Eccup. There are three engines, one a Cornish engine of 300-horse power, and twin engines, each of 100-horse power. The members afterwards drove to the Washburn Valley, and visited the Lindley Wood reservoir. Having completed their inspection here, the party proceeded to Otley, where they dined together. In responding subsequently to the toast of "The Chairman of the Water Committee," Alderman Cooke gave some interesting particulars as to the work that had been accomplished during the past year. In all 14 miles of new mains were laid, at a cost of £6000; and nine miles of old 2½, 3, and 4 inch mains were replaced by larger ones entirely out of revenue. In 1853, the number of houses supplied with water was 25,000; this year the number was 90,000. In 1891-2, the net increase in the number of supplies was no less than 6000. The total storeage capacity of the Eccup, Swinsty, Fewston, and Lindley Wood reservoirs was, he stated, 3900 million gallons, which was the maximum quantity provided for by the Legislature in all modern water-works. The daily demand for Leeds, and for millowners' compensation, was 22 million gallons; and the storeage capacity was equal to 180 days' supply. With regard to distribution, he intimated that it would be necessary shortly to undertake further works. The filter-beds at Weetwood had been in existence for periods varying from fifteen to thirty years, and reconstruction must be at once commenced. It was not intended to exhaust the credit balance by any revolutionary scheme; but year by year to reconstruct the filter-beds, each of which would cost £2000. Service-covered reservoirs at Harehills and Woodhouse Hill, Hunslet, were absolutely necessary, to cope with the present and probable future demand. Referring to the Blackmoor Tunnel, he said that when it was completed, 18 million gallons of water per day could be delivered at the Westwood filter-beds—50 per cent. in excess of the present requirements. Brief allusion was also made to the leakage at the Eccup reservoir; and then, turning to the question of finances, Alderman Cooke pointed out that, whereas the gross income in 1853 was £14,000, it was this year £102,000—an increase of £88,000. After deducting from the gross income the cost of revenue account, interest on debt, and the cost of nine miles of renewals, the profit for the year was £25,000. The repayment to sinking fund for liquidation of debt was £16,000; and the net profit on the year's trading was £9141, as against £6587 in the previous year—being an increase of £2554. Before concluding, Alderman Cooke spoke in complimentary terms of the skilful way in which the Engineer (Mr. T. Hewson) carried out his duties.

The Electrical Exhibition at the Crystal Palace.—At the half-yearly meeting of the Crystal Palace Company last Thursday week, the Chairman (Mr. G. T. Rait) stated that the expenditure in connection with the Electrical Exhibition had been heavy, and the financial results somewhat disappointing to the Directors. Owing to the Exhibition, the fire insurance premium had increased £1200, which was a very serious tax upon the Company.

An Electric Lighting Scheme for Colchester.—At the meeting of the Colchester Town Council on the 3rd inst., a report was presented by the Lighting Committee on the proposed electric lighting of the borough. It concluded with a unanimous recommendation that the Council should take the necessary proceedings for obtaining statutory powers for carrying out a scheme. The motion for the adoption of the report gave rise to a long discussion; but it was eventually carried.

Sales of Shares.—Messrs. Howgate and Chapman recently sold by auction 300 £1 fully-paid shares in the *East Ardsley Gas Company*—200 at £1 10s., and 100 at £1 10s. 6d. each. They also put up 11 shares (£5) in the *Mirfield Gas Company*, which were knocked down at £13 2s. 6d. each.——Three lots of £100 original stock in the *Faversham Gas Company* have just changed hands at £146 per lot, and another similar lot at £147. Nine £10 fully-paid preference shares in the *Faversham Water Company* recently realized £23 per share; 33 £10 ordinary shares fetching £22 10s. each.

Tunbridge Wells Water Supply.—At a recent meeting of the Water Committee of the Tunbridge Wells Corporation, the general question of the water supply of the town was fully considered, and ultimately it was resolved that Mr. J. Mansergh, M.Inst.C.E., should be requested to make a comprehensive report to the Council dealing with the sources of supply, mode of storeage, present and probable future wants of the borough and water district, and generally with the whole of the questions of water supply and water-works of the borough. Some idea of the growing needs of Tunbridge Wells in the matter of its public water service may be gleaned from the fact that the consumption of water by meter during the past quarter was 3,603,000 gallons; the consumption for the corresponding period of last year being 3,422,000 gallons.

The Proposed Purchase of the Accrington Gas and Water Works by the Corporation.—The draft agreement for the purchase of the Accrington Gas and Water Company's undertaking by the Corporation has been agreed to by both parties; and there is every probability now of the negotiations being brought to a satisfactory issue. The hitch arose regarding the following clause: "Subject to the Corporation obtaining a report from Mr. Mansergh, or other engineer to be employed by them, that the undertaking is of the value of the consideration stipulated to be paid for the same." The Company's Solicitor altered the clause to read "that the structural value of the undertaking is of the value at which the works and plant appear in the last balance-sheet issued by the Company." The Directors of the Company have agreed that the former clause shall stand.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

That heterogeneous collection of teachers, which now constitutes almost the "lock, stock, and barrel" of the British Association, have been holding their annual gathering in Edinburgh. It is to be feared that the day of the Association is past. The fierce competition which holds good in other walks of life does not now respect even the domain of science; and any discovery by which a scientist may gather lustre to his name, cannot be held over till the annual meeting of the Association, lest someone else might snatch the laurels from his brow. There are, besides, so many scientific and technical papers, not to speak of the daily press, who are prepared to pay handsomely for original contributions, that a discoverer is tempted to weigh the advantages of, on the one hand, hard cash with the credit of being first in the field, and on the other the somewhat empty honour of having laid his product before the world, without other recompense. It is needless to say which of the alternatives the enterprising scientist chooses. He would not be human if he did not take the course which would be productive of most pecuniary benefit to himself. But the effect on the Association is that many of the papers which are submitted to it are merely a hash-up of something with which the reading public are already quite familiar. There is also this other effect, that a number of young men, who are as yet practically students, come forward with subjects not matured, at sight of which the older members "shie off," lest the ingenuous treatise which is put before them should prove to be nothing more nor less than a clever attempt to "draw" them upon a subject on which the writer wished to have more information. That there is a field for such an Association, no one doubts; but whether under its present form, is another question. It is not for me to say how the Association should reform itself; but I may point out a very significant fact in connection with their Edinburgh meeting, which might make them consider whether or not they are on the right lines. They met at Cardiff last year; and this year, in Edinburgh. The voice of Cardiff was not, so far as I can trace, heard at a single meeting they held. That looks very like as if Cardiff were heartily glad to be quit of them. I speak of what I know, when I say that the prevailing feeling in Edinburgh is that, as it was 20 years since their previous visit, it is hoped it may be much more than twenty years before they again turn their faces thitherward. A body whose social requirements form a heavy tax upon the community which entertains them, is apt to be felt to be a nuisance. If the Association were to visit a town for the discussion of science subjects, and make little fuss, the citizens would feel honoured; but, as the community generally do not care much for science, unless accompanied by "coruscations," a continual round of conversaziones, receptions, excursions, and the like bore them immensely. The "advancement of science" consequently suffers in the estimation of the public. At the Edinburgh meeting, the community betook themselves to country quarters, and so got out of the way; leaving it to those who could not get out of the business, to do the honours. It was matter of regret that so few of them enrolled as members. I venture to predict that, except by a few who follow the teaching profession, Edinburgh will be all but unrepresented at the Nottingham meeting next year.

Of the business done, if one laid aside the legion of papers by aspiring young men who are teachers in science schools or assistants to professors, there would be little to show. The most outstanding of all the papers read was the one by Professor Michelson, on "Spectroscopy." The paper is to be printed *in extenso* in the Records of the Association, and so, by the way, is the paper by Mr. G. F. Deacon, upon the Liverpool water tunnel under the Mersey. A Committee which was to have reported to the Chemical Science Section on "The Proximate Constituents of Coal," gave in an interim report, which merely stated that they were engaged in investigations, and expected to be able to report to next year's meeting. Perhaps the most important item of business connected with the meeting was the arrangement between scientists of different nationalities with regard to the adoption of a universal system of standards of measurement for electricity. The German Government sent over Professor Helmholtz to assist in arriving at an agreement on the subject; and an arrangement was come to, which it is hoped other countries will acquiesce in. Professor Oliver Lodge made a sensible effort to secure a universal system of nomenclature for electric subjects; but he was not able to carry his point. He will, however, doubtless return to it. It should be stated that the Professor was the most practically minded of all the electricians who took part in the proceedings; and not far behind him was Mr. R. T. Glazebrook, of Cambridge. Were all electricians like them, the science which is involved in electricity would not be so much "up in the air" as it usually is. How great a descent there was from these gentlemen to Professor George Forbes. Professor Forbes is a native of Edinburgh; and it was fit that he should there expound his scheme for lighting that city with electricity, by utilizing the heat from the burning of the refuse of the city to pump water, wherewith to drive dynamos. His proposals are received with ridicule everywhere. The citizens will not stand the disfigurement of Arthur's Seat by the construction of a water-reservoir; but apart from sentiment, the proposal is not practicable, because, if town refuse could be made a reliable heat-producing substance, it would be a valuable commodity, and the erection of a destructor to get rid of it would not be necessary. One more remark, and that is upon the absence of subjects connected with the gas industry at the meeting. Is gas manufacture too old-world a subject for modern scientists? or is the gas industry sufficiently attended to on its scientific side at the Associations which exist under its own auspices? These are questions which occur to me; and which, I confess, I cannot answer.

The Edinburgh and Leith Gas Commissioners, having no ordinary meeting this month, held an extraordinary meeting on Monday of this week, at which the chief business was the settlement of the quality of the gas they are to supply during the second half of the current year. The Works Committee, by a majority, recommended that the illuminating power should be retained as at present—from 25 to 27 candles; but, on the motion of Bailie Archibald, this was overthrown by the

Commissioners. Bailie Archibald is in favour of the illuminating power being reduced to from 24 to 26 candles. His object was to enable the Commissioners to bring down the price of gas; and he thinks they might be able to reduce it by 4½d. or 6d. per 1000 cubic feet, if gas of a lower illuminating power were supplied. The whole subject has been sent to the Treasurer for a report, before the Commissioners determine either one way or another. They had also before them the subject of the unaccounted-for gas last year, which, it was reported, was 16 million cubic feet more than it was the previous twelve months. The increase amounts to 1⅛ of the whole output. A Sub-Committee who had considered it gave several reasons for the large advance. The laying of 9½ miles of new mains was answerable for a million; the burning of gas on common stairs beyond the time paid for, caused a large quantity (not estimated); and there were fluctuations in unaccounted-for gas which were experienced everywhere. The Sub-Committee also reported that one of the station meters in the Edinburgh works had been found to be out of order, but had now been repaired. Condensation was not mentioned, nor the inadequate capacity of the purifiers at the Edinburgh works, in consequence of which gas is sometimes sent out at too high a temperature. In a discussion which ensued, it transpired that the station meter which was out of order had been taken over in a broken condition from the Edinburgh Company in 1888. If this were so, the break must have been of very little consequence, or it would have been found out before now.

The Perth Gas Commission, after considering whether they should not have their coal from Fifeshire carried by sea instead of by rail, have resolved to make no change upon existing arrangements, which have been found to be cheaper than would sea carriage. It was reported to the Commissioners that the output of gas during the past month was 407,000 cubic feet over the output in July, 1891. The Commissioners have been in the habit of insuring their workmen against accidents arising through the fault of the employers; but this has now been altered, the Commissioners having agreed to extend the insurance of the men to accidents of every description. The premium paid is £15 a year, on estimated wages of about £3000.

The Dundee Gas Commissioners met on Monday, to appoint an electrical engineer. There were 53 applicants for the post; and out of the list, four names were submitted by the Committee. Only two names were put before the Commission—that of Mr. Walter H. Brownlee, of Glasgow, a son of Mr. Brownlee, the Convener of the Works Committee of the Commission, and that of Mr. Charles Yeaman, of Liverpool. The mover of Mr. Brownlee's name—Mr. Paul—said that Mr. Brownlee's cause might have suffered from the fact that his father held the position of Works Convener to the Board; but he wished to point out that ex-Provost Brownlee had not exercised any influence on behalf his son. On the contrary, his son was standing entirely on his own merits; and he was well qualified for the post of electrical engineer for Dundee. That being so, it could go forth to the public with no uncertain sound that, if Mr. Brownlee got the appointment, he would have obtained it on his own merits as a successful student of Dundee College, where he was under Professor Ewing. The supporters of Mr. Yeaman complained of undue haste in making the appointment; and one of them stated that Mr. Brownlee had not obtained first-class honours, whereas Mr. Yeaman's testimonials were first class. The Commission, by 11 votes to 9, appointed Mr. Brownlee to the post. The salary is £200. One cannot criticise a gentleman who has not yet entered upon his duties; but the remark may be made regarding the Commission that it looks strange to see, first of all the engineer, and then the manager of the electric lighting installation the relatives of local men.

On Wednesday the employees of the Dundee Gas Commission were treated to their annual excursion. The party visited the beautiful grounds surrounding Monikie Reservoir, and enjoyed themselves in dancing and games. Mr. J. M'Crae, the Engineer, who looked after the arrangements, before starting on the journey home, called for three cheers for the Gas Commission; and these were heartily given.

The Helensburgh Gas Company have resolved to retain the price of gas for lighting purposes at 5s. per 1000 cubic feet; but to reduce the charge for gas used for cooking and heating purposes, from 4s. 6d. to 3s. 8d.

In Port Glasgow during the past year, there was a revenue from the sale of gas of £4533. The total revenue of the gas undertaking was £5461, and the total expenditure £4848, which left a surplus of £613. Coal has been purchased for the current year at an average price of 13s. 10d. per ton. The residuals have been sold for the current year at the price of 2s. 9d. per 100 gallons.

It was reported to the Dunbar Gas Commissioners on Wednesday that Mr. M'Kechnie, the new Gas Manager, recommended the purchase of coal for the current year at an average price of 15s. per ton. This, it was stated, was about 10d. per ton below former rates. A reduction in the price of gas was spoken about; but nothing further was done except to approve the recommendation.

The Extensions at the Halifax Gas-Works.—In previous issues of the JOURNAL reference has been made to the extensions which are being carried out at the Halifax Gas-Works, in order to bring them into a condition to meet the increased demands upon them. The necessity for these changes will be appreciated when it is stated that the consumption of gas in Halifax to-day is twice as much as it was eleven years ago. The work at present in hand will entail an expenditure of £10,000; but a further sum of £17,650 has been spent in the acquisition of land to allow of future development. The alterations contemplated and in progress include the reconstruction of two retort-benches on the regenerative system, with retort-charging and coal-conveying machinery; additional condensers; Claus sulphur-recovery plant; and increased gasholder capacity. It is expected that the present extensions will tide the Corporation over the next ten years. In mid-winter, the weekly production of gas in the borough is about 22 million cubic feet. At the last meeting of the Gas Committee, it was decided to apply to the Local Government Board for sanction to the Corporation borrowing £100,000 for gas-works purposes.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 13.

Sulphate of Ammonia.—The market remains steady; the demand being commensurate with the present production. Business on the whole, however, is dull—quite contrary to what might be expected, when the small stocks in consumers' hands, and the near approach of the autumn requirements, are considered. The future from the present standpoint is very uncertain. Hardly any contracts are available—a considerable premium being expected; while prices are too low to tempt "bear" operations. A hand-to-mouth business may be likely to continue for some time; and the market may be considerably swayed by the extent of the requirements. Business in spot parcels has been done at £9 17s. 6d. Some makers, however, hold for more money. Nitrate has a somewhat firmer tendency; but buyers are not eager.

LONDON, *Aug.* 13.

Tar Products.—Things remain very flat in this market generally. Benzol is rather easier—90's being 1s. 7d.; and 50's, 1s. 3d. Pitch keeps fairly steady at 26s. to 27s.; and anthracene, at about 9½d. for "A" quality, and 6½d. for "B" quality. Carbolic and cresylic acids are much inquired for, and continue to obtain comparatively higher prices; cresylic acid having been sold at from 1s. 8d. to 1s. 9d. Current prices are as follows: Tar, 8s. to 10s. 6d. Pitch, 27s. Benzol, 90's, 1s. 7d.; 50's, 1s. 3d. Toluol, 1s. 2d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 7d. Creosote, 1d. Naphthalene, 20s.; pressed, 40s. Crude carbolic acid, 60's, 1s. 6d.; 70's, 1s. 9d.; crystals, 6½d. Cresols, 1s. 8d. Anthracene, 30 per cent., "A" quality, 9½d.; "B" quality, 6½d.

Sulphate of Ammonia stands at much the same quotation as last week. Gas liquor (10-oz.) is quoted at 5s. 6d. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The coal trade generally throughout this district remains in much the same languid condition that I have reported of late—at least, as far as the demand for all descriptions of round coal is concerned; but with the restricted output, there is no really large accumulation of stocks. Quotations at the pit mouth remain at 12s. to 12s. 6d. for best Wigan Arley; 10s. to 10s. 6d. for Pemberton four-feet and second qualities of Arley; but as far as present business is concerned, the maximum quotations are little more than nominal. In the lower qualities of round coal, there is a continued want of firmness; and prices are very irregular, where anything like quantities are involved. Steam and forge qualities for inland requirements are still quoted at about 7s. 9d. to 8s. per ton, at the pit mouth; whilst the best Welsh steam-coal is readily obtainable, delivered in wagons at Birkenhead, at about 9s. 6d. per ton. In gas coal there are very few contracts that remain unsettled, and these are for no large quantities; but where any business is just now being completed, it is generally on the basis of quite 6d. under the average prices ruling last season. At the pit mouth, best Wigan gas coal does not average more that 9s. 6d. to 9s. 9d. per ton, with inferior descriptions varying from about 7s. 9d. per ton upwards. Coke continues in generally active request; and local makers are moving off all their present production without difficulty—best qualities fetching as much as 17s. per ton, at the ovens. For engine classes of fuel, there is a continued active demand. Good qualities of burgy fetch quite 6s. 6d. to 6s. 9d.; the best qualities of slack, 5s. 3d. to 5s. 6d.; medium sorts, 4s. 3d. to 4s. 9d.; with some common slack obtained at from 3s. 3d. to 3s. 9d. per ton. Yorkshire slack is, however, offering in this market more freely, and at lower prices, which must tend to weaken somewhat the position of Lancashire colliery owners.

Northern Coal Trade.—The coal trade is, if any way changed, slightly easier the past few days. Steam coal is in steady demand; but there is no pressure, and prices are barely maintained at about 10s. 6d. per ton f.o.b. for best Northumbrian steam coals. Second qualities are about 1s. per ton lower; and small steam, being very abundant, are weak in price. In gas coals, there is a good demand; and the conclusion of some of the great contracts has been decided on. It is believed that close upon one-half of the great London contract has been allotted to collieries in Durham, and will be shipped from the Tyne, Wear, and West Hartlepool. The price has not been officially announced; but it seems to be the general belief that it will leave not much above 7s. 9d. per ton f.o.b. For odd cargoes of gas coals the price asked is about 9s. per ton. The collieries are now working very well, and the output of the men is large; and thus there is a full supply of coal, and stocks are being increased by some of the great gas companies. Bunker and manufacturing coals are quiet. There is more demand for coke for the blast furnaces; and the price is steadily maintained, though it varies with different firms. Gas coke is not materially altered; but the production is now being enlarged, so that there will soon be more in the local markets.

Scotch Coal Trade.—In the coal market last week there was a decided weakness in the demand for splint. Main was also easy; and the only approach to a demand was for ell and for steam coal, most of which went to the Continent. The market generally has been ruled by the North of England and Welsh markets, which are both reported easier. Durham appears to be taking its proper place; and the effect is to cut down the abnormal demand which, in the early summer, made the Scotch coalmasters exceptionally busy. The shipments, however, keep up; orders which were placed early in the summer not being yet worked off. For the past week they amounted to 157,575 tons—an increase of 8602 tons over the previous six days, and of 7654 tons over the corresponding week of last year. For the year to date, the total shipments have been 4,381,840 tons—an advance of 584,735 tons over the same period of last year. The prices quoted were: Main, 7s. 3d. to 7s. 6d.; ell, 8s. 3d. to 8s. 6d.; splint, 7s. 6d. to 8s.; and steam, 10s. to 10s. 3d. per ton.

Carburetting Apparatus for the Rochdale Gas-Works.—At the last meeting of the Rochdale Town Council, Alderman Petrie announced that the Gas Committee had decided to purchase a carburetting apparatus, at a cost of about £500.

Sulphur in London Gas.—Mr. Dibdin's return for the week ending the 6th inst. shows a considerable diminution in the sulphur impurity in the South Metropolitan Company's gas, although there was an excess at the Plumstead testing-station. The means recorded range from 20·9 grains to 25·7 grains per 100 cubic feet. At the Peckham station, where sulphur has lately been in excess, the mean for the week was 12·7 grains; and at the Blackfriars station it was 16·4 grains.

A New Storeage Reservoir for Bolton.—The Bolton Corporation have just completed the construction of a new reservoir at High Rid. Mr. Swindlehurst, the Water Engineer, estimated the cost at £27,487; and the actual outlay is £198 within this sum. The work was commenced in March, 1889; but six months were lost owing to the failure of the original contractor. Besides, the weather during the year was bad, the men engaged not doing a full week's work between March and November.

The West Bromwich Gas Undertaking.—At the last monthly meeting of the West Bromwich Town Council, the Gas Committee presented an extract from the accounts of the gas undertaking for the year ending March 31, 1892, which, with the report on the general working, noticed in the JOURNAL for May 21 last, have been issued by the Secretary and Accountant (Mr. T. Hudson). The Committee recommended the Council to transfer from the accumulated profits the sum of £1000 in aid of the general district rate of the borough, in two half-yearly moieties. Alderman Fanley, in moving the approval of the recommendation, expressed regret that the results of the past year's working had not been so favourable as those for the year 1890-91; the net surplus being only £691, as compared with £1825. The Committee were, however, investigating the cause of the falling off. After some discussion, the motion was carried. The decrease in the profits is accounted for in the financial statements attached to Mr. Hudson's report, as well as in the report itself. The total cost in the manufacturing department was higher by £1292 last year than in 1890-91—the total increased expenditure amounting to £1484; whereas the income increased by only £728. The cost of coal for gas making and firing absorbed 46½ per cent. of the total income for the year, or nearly 2 per cent. more than before. The balance of income over expenditure was £8510, or 5·27 per cent. on the capital employed, as compared with £9266 in 1890-91.

The Price of Gas at Bury.—At the last meeting of the Bury Town Council, Mr. Byrom, in moving the adoption of the proceedings of the Gas Committee, gave an explanation as to why there had been no distribution of the share of profits to the gas consumers. In doing so, he said he should have to refer back to 1886. At that time the price of gas was 2s. 11d. per 1000 cubic feet, with a share of profits of 4d. per 1000 feet returnable to the consumer. In 1887 the price was still 2s. 11d.; and it was the same in the following year, when a discussion took place about paying income-tax upon the profits made at the gas-works. It was then decided to sell the gas at cost price; and in 1889 the charge was reduced to 2s. 1d. per 1000 cubic feet, less 1d. for discount on prompt payment. This left no profit; but there was still an accumulation of between £5000 and £6000 remaining from previous years. In 1890 the price of gas was increased to 2s. 4d., with a returnable sum of 4d. per 1000 cubic feet as the share of profits from the accumulated sums for the previous five years. By this arrangement £4143 was absorbed. The year following (1891), the price of gas was again reduced to 2s. 3d., less 3d. as part of the share of profits; and this absorbed the remainder of the accumulated funds, amounting to £3440; leaving only £488 to carry forward. They were thus unable to return anything to the consumers. The gas was sold at nearly cost price, and the consumers could not have a share of profits as well. The cost of production was no more than in other towns; and their charge was lower than in any other place in Lancashire, except one. The minutes were approved.

The Proposed Enlargement of the Smethwick Gas-Works.—At a meeting of Smethwick Local Board last Friday, Mr. J. Newey presiding, the Clerk (Mr. W. Shakespeare) reported that the Local Government Board had consented to the Board borrowing £6292, instead of £9000, to cover the cost of the alterations and additions at the gas-works. The Department intimated that they would sanction a loan for so much of the estimated cost of the new works as was represented by the total of the outstanding debt on the works to be superseded; and they were willing to take this amount at £2708. This deducted from the £9000 left £6292 as the maximum. As, however, they could not, under the Local Board's Act, fix the time for the repayment within the periods for which they considered it might reasonably be anticipated that the works would remain in good condition, the Act would require to be amended by a Provisional Order, enabling the Local Government Board to prescribe the time for repayment in the case of each particular loan. They granted their sanction to the loan named above on condition that the Board would consent to apply forthwith for an Order for the amendment of the Local Act of 1876 and the Provisional Order of 1882, so far as regarded these matters. The Local Government Board were prepared to sanction a loan of £6292 for the execution of the proposed works, on being furnished with an undertaking of the Local Board to repay £4813 of the loan in 30 years; £931 in 20 years; and £544 in ten years. He explained, in the course of a discussion, that the Department wished the Local Board to take the course they suggested so as to make the repayments legal; and the loan was only sanctioned on condition that their recommendations were complied with. If they applied for a new Provisional Order, he thought they should ask to have a number of new clauses inserted, giving them the power of paying off all the loans out of the sinking fund. They had a considerable sum, amounting to £12,000 or £14,000, and a mortgage of £6000 which they should pay off just now. He thought if these clauses could be inserted, it would be a good thing for the Board. They should take power to invest the money in any way in which they could secure the best rate of interest. The Clerk was instructed to take steps to carry out the recommendations of the Local Government Board in the matter.

Exhibitions of Gas Appliances.—An exhibition of gas appliances was opened in the Town Hall, Tavistock, on the 3rd inst., under the auspices of the Tavistock Gas Company. The stove exhibits were furnished by Messrs. Richmond and Co., Limited, of Warrington and London; and Messrs. Willey and Co., of Exeter, showed a handsome and varied collection of gas lamps, fittings, and other apparatus. The general arrangements were under the supervision of Mr. A. Francis, the Manager of the Gas Company. The exhibition was open for three days, on each of which Miss Golding gave two lectures on cookery. An exhibition of Parkinson's gas cooking and heating appliances was held in the Town Hall, Smethwick, last week. Miss Thwaites, of Liverpool, gave a series of practical lessons on cookery.

A Comparison of Lighting by High-Power Gas and Incandescent Electric Lamps.—Apart from the advantages possessed by high-power lamps of the Wenham type in the facilities they afford for combining efficient ventilation with superior gas lighting, it can be demonstrated conclusively that considerable economy is effected by employing them instead of incandescent electric lamps. This is shown by taking two installations, each of 3000-candle power. Assuming that the incandescent lighting is made up of 20 lamps of 50-candle power, 30 of 32-candle power, and 65 of 16-candle power, 10,500 watts per hour would be used; and further assuming that the period of lighting would be 1000 hours per annum, 10,500 electrical units would be necessary to feed the lamps. These, at 2½d. per unit—a fair average—would come to £109 7s. 6d., to which must be added lamp renewals after every 1000 hours' burning, which would add £23 3s. 9d.—making together, £132 11s. 3d. Let us compare this with an installation of Wenham lamps. Thirty of these, of the No. 1 size, would consume 300 cubic feet of gas per hour, or 300,000 cubic feet for 1000 hours; but as the lamps would probably be burning in the bye-pass for a part of the year in addition to the time they were actually in use for lighting purposes, another 100,000 cubic feet may be allowed for this—making a total of 400,000 cubic feet. This, at 3s. per 1000 cubic feet, would come to £60; and reckoning £15 for renewals (10s. per lamp) we have a total of £75. The difference between the two systems, therefore, is £57 11s. 3d. in favour of gas.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 288.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16—17	..	6 3 6
100,000	10	,,	7½	Do. 7 p. c.	10	11—12	..	6 5 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	103—105	..	4 15 3
100,000	20	27 May	8	Bahia, Limited	20	10—12	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6—6½	..	5 15 9
40,000	5	,,	7½	Do. New	4	4—4½	–¼	6 13 4
380,000	Stck.	12 Aug.	12½	Brentford Consolidated	100	210—215*	+1	5 13 10
150,000	,,	,,	9½	Do. New	100	162—167*	+1½	5 10 9
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	11 Mar.	5	Bristol	100	95—100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	41—43	..	5 4 8
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	—	—	Buenos Ayres (New) Limited	10	6½—7½	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	92—95	..	6 6 4
150,000	20	12 Aug.	8	Cagliari, Limited	20	25—27*	+1	5 18 6
550,000	Stck.	13 Apr.	13	Commercial, Old Stock	100	233—238	..	5 9 3
165,000	,,	,,	10	Do. New do.	100	180—185	..	5 8 1
130,000	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	120—125	..	3 12 0
800,000	Stck.	15 June	13	Continental Union, Limited	100	220—224	..	5 16 1
200,000	,,	,,	10	Do. 7 p. c. Pref	100	185—195	..	5 2 7
75,000	Stck.	30 Mar.	10	Crystal Palace District	100	185—190	..	5 5 3
486,090	10	28 July	10	European, Limited	10	19—20	..	5 0 0
354,660	10	,,	10	Do. Partly paid	10	14—15	..	5 0 0
5,470,820	Stck.	12 Aug.	12	Gaslight & Coke, A, Ordinary	100	211—215*	..	5 11 7
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95—98*	..	1 1 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	250—255*	+2	3 18 5
30,000	,,		5	Do. F, 5 p. c. Prf.	100	116—121*	+½	4 2 7
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	166—171*	+½	4 7 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	154—159*	+½	4 8 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	248—253*	+1	3 18 11
476,000	,,		6	Do. K, 6 p. c. Prf.	100	145—150*	..	4 0 0
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	115—117	+1	3 8 5
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	119—123	..	3 13 2
908,000	,,	,,	6	Do. 6 p. c. do	100	164—169	..	3 11 0
3,800,000	Stck.	12 May	12	Imperial Continental	100	222—226	+1	5 6 3
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5p. c. Deb.	100	108—110	..	4 10 11
541,920	20	15 June	5	Monte Video, Limited	20	13¾—14¼	..	6 18 0
150,000	5	27 May	10	Oriental, Limited	5	8¾—8¾	..	5 14 3
60,000	5	30 Mar.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2—3	..	—
				People's Gas of Chicago—				
420,000	100	3 May	6	1st Mtg. Bds.	100	106—110	..	5 9 1
500,000	100	1 June	6	2nd Do.	100	100-103	..	5 16 7
150,000	10	15 Oct.	10	San Paulo, Limited	10	8—9	..	—
500,000	Stck.	26 Feb.	15½	South Metropolitan, A Stock	100	273—278	+3	5 11 6
1,350,000	,,	,,	12	Do. B do.	100	223—228	+3	5 5 3
200,000	,,	,,	13	Do. C do.	100	235—245	+5	5 6 1
725,000	,,	14 July	5	Do. 5 p. c. Deb. Stk.	100	140—144	..	3 9 6
60,000	Stck.	11 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
743,952	Stck.	1 July	10	Chelsea, Ordinary	100	245—250	..	4 0 0
1,720,252	Stck.	13 Apr.	8	East London, Ordinary	100	193—198	..	4 0 10
544,440	,,	1 July	4½	Do. 4½ p. c. Deb. Stk.	100	138—142	+1½	3 3 4
100,000	50	1 July	5½	Grand Junction	50	100—104	..	4 1 9
708,000	Stck.	12 Aug.	11	Kent	100	258—263*	+1½	4 3 7
1,043,800	100	1 July	9½	Lambeth, 10 p. c. max.	100	216—221	..	4 5 11
406,200	100	,,	7½	Do. 7½ p. c. max.	100	190—194	..	3 17 3
279,700	Stck.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	123—128	+2	3 2 6
500,000	100	12 Aug.	12½	New River, New Shares	100	320—330*	+1	3 13 6
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	126—129	+1	3 2 0
902,300	Stck.	15 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	145—150	..	4 6 8
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	134—138	..	4 14 3
1,155,066	Stck.	15 June	10	West Middlesex	100	236—241	..	4 3 0

*Ex div.

The Gas Workers' Union and the Eight-Hour Day.—The annual celebration of the granting of an eight-hour day to the London gas workers took place on the afternoon of Sunday, the 7th inst., upon the Eelbrook Common, Fulham. The meeting was preceded by a procession of members of the Gas Workers' and other Unions, with bands and banners, who marched from Battersea to the place of meeting. There was a very large attendance. Mr. Mark Hutchins, President of the Gas Workers' Union, was in the chair; and in opening the meeting he said they had met for a two-fold object—to celebrate the granting of eight hours to the gas workers three years ago, and also the return for the first time of two real Labour candidates to Parliament—John Burns and Keir Hardie—who could both do a great deal more than his hearers might think possible. Mr. W. Thorne apologized for the absence of Mr. Burns. He said their organization had now lasted four years, and had completely falsified the prophecies of those who said it would soon split up. Throughout the country both chemical and gas workers had, through their Union, been granted an eight-hour day. Theirs was the first unskilled organization which existed in this country; and he was sorry to say that a great many men who had obtained higher wages and less hours through its means had fallen away from it. He thought this must be a mistaken policy, because the first sign of weakness on the part of a trade union would lead the employers to at once commence to withdraw some of the benefits obtained. During the existence of their Union, they had spent £35,000 in strike pay. Lately they had turned attention to the insurance of their members against accident, and the enforcing of claims under the Employers' Liability Act. He trusted that the enthusiasm for trade unionism which was so great two years ago would not be allowed to decline; and he concluded by urging upon the meeting the necessity of a legal eight-hour day, which, he said, had now come within the range of practical politics, as the cheapest and easiest way in which the hours of labour could be shortened.

Pernambuco Water Company, Limited.—A meeting of the debenture-holders of this Company was held at Winchester House on the 28th ult., to consider the position of affairs, and to take such action as might be considered desirable in view of the fact that the Company had made default in payment of its debentures. Mr. R. H. C. Harrison presided. Mr. Harold Brown (a member of the firm of Messrs. Linklater and Co., who convened the meeting) made a short explanatory statement with reference to the Company, and said that the drawings up to and inclusive of those in December of last year had been paid; but default had been made in paying bonds drawn in June of this year, in the payment of interest on the first mortgage bonds, and, he presumed, of the interest on the second mortgage bonds also, although he did not know. The Chairman said it appeared to him that they would not be able to do much until they received the accounts, and were able to see what money was earned last year, and what had become of it. As to any foreclosure, he believed nothing could be done within six months; so that they were precluded from taking this step until January next. Mr. E. L. Weigall (a representative of the London agents of the Company, Messrs. Knowles and Foster) said he could not do better than read a circular his firm had issued in reference to the default, which they explained to be owing to the following circumstances: "(1) Although the revenue in Brazilian currency has not fallen off during the last year, but rather increased, its sterling value, owing to the rapid decline in exchange, is now considerably less than half what it was two years ago. (2) Owing to the excessive purity of the water, a chemical action has taken place, which has affected the iron conduit pipes to the houses, causing a deposit and the escape of water through the hydrometers without registration, and householders are, in the majority of cases, only paying the minimum tax of three milreis per month." Messrs. Knowles and Foster added that they had themselves every confidence in the integrity and good faith of the Company. It was eventually resolved—"That a Committee of first and second bondholders be appointed to protect and enforce their rights, and that the Committee be requested to consider and report to the bondholders what steps they think should be taken with that object." The Committee were subsequently nominated.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO., TELEPHONE No. 2698.

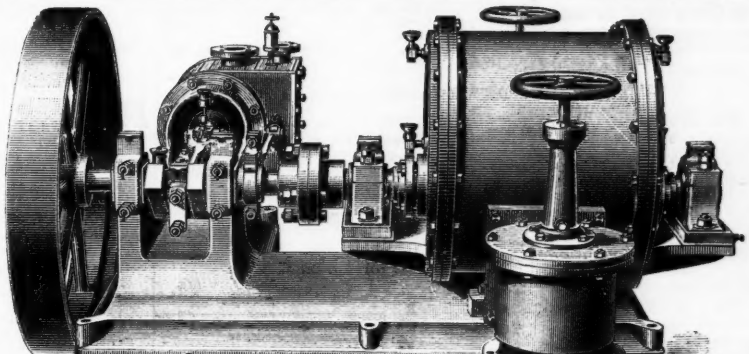
HYDRAULIC AND GAS ENGINEERS, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES HYDRAULIC REGULATORS VACUUM GOVERNORS STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
ANDREW STEPHENSON, Sole Agent, 182, Gresham House, Old Broad Street, LONDON, E.C.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. IV., centre of JOURNAL.
Cablegrams: "Igniter London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Samples and Price on application. OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

OLPHERT'S OXIDE.

FINEST Quality of Natural Bog Ore.
Apply for particulars to the Sole Agent, Mr. THOS. L. ARCHER, Cathedral Chambers, Half Street, MANCHESTER.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

LIQUOR and Tar wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

JOHN RILEY & SONS, Chemical Manu-
facturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

HUTCHINSON BROTHERS, Barnsley,
Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

TUBES.

FOR Gas, Steam, and Water; Galvanized,
White Enamelled, and Hydraulic Tubes, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

ADVERTISER seeks a re-engagement
as SECRETARY to a Company, or any similar POSITION OF TRUST. Has had considerable experience in Limited-liability work, Secretarial and otherwise. Can supply the highest references and testimonials.
Address No. 2127, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a leading Stoker. Must be
tall, active, and strictly temperate. Wages 4s. per day.
Apply to the MANAGER, Gas-Works, Romford, ESSEX.

WANTED, an experienced Draughts-
man, by a Firm in Westminster. One familiar with Gas-Works Construction preferred.
Address, stating qualifications and salary expected, No. 2131, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Rental Clerk used to the
routine of a Gas Office. Three testimonials of recent date to accompany application. State age and salary required.
Address No. 2130, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Gas-Works in the
Midlands, a WORKING FOREMAN. Must have had experience in Carbonizing, Management of Men, and Main and Service laying. Wages, 30s. per week. To a steady and industrious man, the position would be a permanency.
Apply, with testimonials, stating age, &c., to No. 2129, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, to purchase, a small Portable
GASHOLDER.
Apply, stating all particulars and price, to the BUCKLEY GAS COMPANY, LIMITED, 7, Henblas Street, WREXHAM.

FOR SALE—A perfectly new 20,000
cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
For further particulars, apply to Mr. T. G. MARSH, 41, Corporation Street, MANCHESTER.

FOR SALE—A Set of Four Second-Hand
PURIFIERS, each 12 ft. by 8 ft. by 4 ft. deep, made in Plates, having 12-inch Lutes and Wrought-Iron Covers, together with 10-inch Hydraulic Valves and Lifting Apparatus. All in good condition.
For further particulars, apply to THOMAS TURNER, Manager, Gas-Works, AIRDRIE, N.B.

GAS-METERS FOR SALE.

THE Royal Agricultural Hall Company,
Limited, Islington, have FOR SALE one 500-LIGHT DRY METER, and one 200-LIGHT DRY METER, which until recently have been used at the Hall, and are in good working order.
Apply to R. VENNER, Secretary, Royal Agricultural Hall Company, Limited, ISLINGTON.

TO TAR DISTILLERS.

THE Gas Committee of the Corporation
of Blackpool are prepared to receive TENDERS for the surplus TAR produced at their Works during the next Twelve months from Sept. 1 (about 1200 tons).
Tenders, endorsed outside, to be addressed to the Chairman by the 27th of August inst.
Particulars from the undersigned.
JOHN CHEW,
Engineer.
Gas Office, Blackpool,
Aug. 14, 1892.

TO PIPE FOUNDERS.

THE Gas Committee of the Corporation
of Blackpool are prepared to receive TENDERS for the supply of about 400 tons of 12-inch and 8-inch GAS-PIPES, of average weights, turned and bored, coated and tested, delivered at Gas Siding, Central Station here, and also about 10 tons of SPECIALS.
Tenders, endorsed outside, to be addressed to the Chairman by the 27th of August inst.
Specification, &c., on application to the undersigned.
JOHN CHEW,
Engineer.
Gas Office, Blackpool,
Aug. 14, 1892.

SADLER AND CO., LIMITED,
MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 70, Wellington Street, GLASGOW; 58, Fountain Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works,
LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

TO INVENTORS AND OTHERS.

PATENTS for Inventions Secured and
TRADE MARKS REGISTERED throughout the World. Advice on all matters connected with the above. Handbook gratis on application.
J. C. CHAPMAN, C.E., Chartered Patent Agent, 70, Chancery Lane, LONDON.

OXIDE OF IRON. Genuine Natural Bog
ORE. QUALITY AND CONDITION GUARANTEED. Any quantity supplied at lowest rates.
D. M. NELSON AND SONS, 68, Bath Street, GLASGOW. Telegraphic Address: "Gas, Glasgow." Depôts throughout England and Scotland.

DRAWINGS, Tracings, Specifications,
Quantities, &c., prepared by an experienced Engineering Draughtsman. Plans of Works made, copied, or enlarged. Blue copies made. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. L. FEATHERSTONE, 173, Fentiman Road, LONDON, S.W.

BOROUGH OF DARWEN.

TENDERS FOR OXIDE OF IRON.

THE Corporation are prepared to receive
TENDERS for the supply of 100 tons OXIDE OF IRON; also for the purchase of 150 tons SPENT OXIDE.
Particulars may be obtained on application to MR. THOS. DUXBURY, Gas Engineer, DARWEN.

DARWEN CORPORATION GAS-WORKS.

TENDERS FOR TAR.

THE Gas Committee of the above Cor-
poration invite TENDERS for their surplus TAR for One year (about 800 tons), delivered on the Railway in Contractor's Tanks.
Sealed tenders, endorsed "Tar," will be received by the undersigned up to Twelve Noon, Aug. 29 inst.; but any further particulars must be obtained from Mr. T. Duxbury, Gas Engineer.
By order,
CHAS. COSTEKER,
Town Clerk.
Darwen, Aug. 13, 1892.

TO COAL MERCHANTS, SHIP OWNERS, AND OTHERS.

THE Directors of the Torquay Gas
Company are prepared to receive TENDERS for the supply of about 8000 tons of best approved DURHAM GAS COAL, to be delivered before the 1st of May, 1893.
Further Particulars and Forms of Tender to be obtained from Mr. Beynon, the Manager of the Company, Hollacombe, Paignton; and tenders to be sent to the undersigned on or before the 24th inst.
The lowest tender not necessarily accepted; and the Directors reserve the right to accept part of any tender.
By order,
JOHN KITSON,
Secretary.
Torquay, Aug. 10, 1892.

CORPORATION OF WARRINGTON.
(GAS DEPARTMENT.)

TENDERS FOR TAR.

THE Gas Committee of the Warrington
Corporation invite TENDERS for the purchase of the surplus TAR produced at their Works to the 25th of March, 1893.
Sealed and endorsed tenders, addressed to the Chairman of the Gas Committee, must be sent in on or before the 25th inst.
Further information can be obtained on application.
The Committee do not bind themselves to accept the lowest or any tender.
FREDK. TAYLOR,
Secretary.
Gas Offices, Warrington,
Aug. 12, 1892.

GAS TAR. SPENT OXIDE.

THE Widnes Local Board invite Tenders
for: (1) The purchase of about 700 tons of GAS TAR from their Gas-Works for the Twelve Months ending the 30th of September, 1893. (2) The purchase of the present stock of SPENT OXIDE, about 150 tons.
Forms of Tender and Conditions of Contracts may be obtained from Mr. Isaac Carr, C.E., Gas-Works, Widnes.
Endorsed tenders to be delivered to the undersigned not later than the 23rd inst.
The Board do not bind themselves to accept the lowest or any tender.
H. S. OPPENHEIM,
Clerk.
Town Hall, Widnes,
Aug. 10, 1892.

FRIEDRICH LUX, Ludwigshafen am
Rhein; and at No. 142, Great Portland Street London, W.
LUX's Gas Regulators for every consumption.
LUX's single-stem Pressure-Gauges.
LUX's Regulator for Gas-Engines.
LUX's Gas-Balance.
LUX's new Gas Regulator for Inverted Lamps and other Apparatus for Gas Lighting, &c.

SHREWSBURY GASLIGHT COMPANY.

EXHIBITION OF IMPROVED GAS LIGHTING.
MUSIC HALL BUILDINGS, SHREWSBURY,
24th, 25th, 26th, 27th, and 28th of October, 1892.

THE Directors invite Makers of suitable
Apparatus to exhibit the same.
Full information as to space and conditions may be obtained on application to
WM. BELTON, Assoc.M.Inst.C.E.,
Manager, &c.
Shrewsbury,
Aug. 8, 1892.

COLNEY HATCH GAS COMPANY.

NOTICE is hereby given, that the
ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Company's Offices, New Southgate, on Thursday, the 1st day of September next, at Six o'clock in the Evening precisely, to receive the Report of the Directors, and the Accounts of the Company for the Half Year ended the 30th of June last, to declare Dividends, and for other purposes.
By order,
W. H. HARDY, F.C.A.,
Secretary.
Aug. 12, 1892.

BROMLEY GAS CONSUMERS' COMPANY.

NOTICE is hereby given, that the
ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the "Bell Hotel," Bromley, Kent, on Thursday, the 25th day of August inst., at Six o'clock precisely, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, to declare Dividends, and for General Business.
The Transfer Books will be closed from the 12th to the 25th of August, 1892, both days inclusive.
By order of the Board,
HENRY W. AMOS,
Secretary.
Offices: At the Works, Bromley,
Kent, Aug. 10, 1892.

RIDDINGS DISTRICT GAS COMPANY.

NOTICE is hereby given, that the
ORDINARY HALF-YEARLY MEETING of the Shareholders of the above Company will be held at the Offices of the Company, No. 30, Gracechurch Street, in the City of London, on Friday, the 26th day of August, 1892, at Two o'clock in the Afternoon precisely, to receive the Report of the Directors and the Accounts for the Half Year ending the 30th day of June, 1892; to declare a Dividend; and to transact the General Business of the Company.
The Transfer Books will be closed from the 13th to the 26th of August, both inclusive.
By order of the Board,
ALFRED LASS,
Secretary.
Offices: 30, Gracechurch Street,
London, Aug. 6, 1892.

RIDDINGS DISTRICT GAS COMPANY.

NOTICE is Hereby Gived that the
ORDINARY HALF-YEARLY MEETING of the Shareholders of the above Company will be held at the Offices of the Company, No. 30, Gracechurch Street, in the City of London, on Friday, the 26th day of August, 1892, at Two o'clock in the Afternoon precisely, to receive the Report of the Directors and the Accounts for the Half Year, ending the 30th day of June, 1892, to declare a Dividend, and to transact the General business of the Company.
The Tronsfer Books will be closed from the 13th to the 26th of August, both inclusive.
By order of the Board,
ALFRED LASS,
Secretary.
Offices: Gracechurch Street,
London, Aug. 6, 1892.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that the
ANNUAL ORDINARY GENERAL MEETING of the Proprietors in this Company will be held at the Offices, Willoughby Lane, Tottenham, on Saturday, the 27th day of August inst., at Three o'clock in the Afternoon precisely, to receive the Report of the Directors, and Statement of Accounts for the Half Year ended the 30th of June last, to declare Dividend, for the Election of Two Directors and an Auditor for the ensuing year, and for transacting General Business.
The Transfer Books for Consolidated Stocks will be closed from the 12th to the 29th inst., both days inclusive.
By order of the Board,
JAMES RANDALL,
Secretary.
Offices of the Company,
Willoughby Lane, Tottenham,
Aug. 12, 1892.

Price 2s. per dozen, or 10s 6d. per 100, post free.

CONSPIRACY and Protection of Pro-
perty Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.
Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.
*** *The Act extends to Scotland and Ireland.*

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

LLANELLY GASLIGHT COMPANY.

THE Directors are prepared to receive TENDERS for the supply of about 6000 tons of GAS COAL, to be delivered during the next Twelve months.

Particulars and Form of Tender may be obtained on application to the Secretary.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders to be sent to the Chairman, endorsed "Gas Coal," on or before Aug. 23, 1892.

FRANK VIVIAN,
Secretary and Manager.

Llanelly,
Aug. 4, 1892.

TENDERS FOR TAR.

THE Directors of the Exeter Gaslight and Coke Company invite TENDERS for their surplus TAR for One year, from the 14th day of October next.

Delivery on Company's Works, filled into purchaser's tanks.

Payment, Cash Monthly.

Sealed Tenders, endorsed "Tender for Tar," will be received by the undersigned on or before Wednesday, the 31st of August next; but the Directors do not bind themselves to accept the highest or any tender.

By order,
W. A. PADFIELD,
Secretary and Manager.

Exeter, Aug. 5, 1892.

TO COAL OWNERS.

THE Directors of the Hornsey Gas Company invite TENDERS for the supply and delivery of 15,000 tons of best screened GAS COAL, in lots of 5000 tons each. Deliveries to be made, as required, from the 1st of October next to the 1st of September, 1893.

Further particulars may be obtained from the undersigned.

Sealed tenders, addressed to the Chairman of the Hornsey Gas Company, 63, Chancery Lane, W.C., to be sent in on or before Thursday, the 25th inst., endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

H. J. MITCHELL,
Manager.

Gas-Works, Hornsey, N.,
Aug. 8, 1892.

HEALTH EXHIBITION, New Drill Hall, Portsmouth, including Sanitary Apparatus and Appliances, Arrangements for Water Supply, Heating and Cooking Apparatus, Electric Lighting, Smoke-Preventing Appliances, Articles relating to Personal Hygiene, Domestic Economy, Foods, Cloth ng, Life and Labour Saving Appliances, &c., to be held from Sept. 12 to Oct. 8, 1892, in connection with the Autumn Congress of the Sanitary Institute.

Prize Medals and Certificates of Merit will be awarded for approved exhibits.

Forms of Application for Space and all Particulars can be obtained from the CURATOR, Mr. W. H. Knight, 74A, Margaret Street, LONDON, W.

STOCKTON-ON-TEES CORPORATION.

TENDERS FOR GAS COAL.

THE Gas Committee of the above Corporation invite TENDERS for the supply, in whole or in part, of 30,000 tons of GAS COAL for the year ending Aug. 31, 1893.

Particulars and Form of Tender can be obtained on application to the undersigned, at the Gas-Works.

Tenders, sealed, and endorsed "Tender for Gas Coal," to be sent in not later than Noon of the 25th day of August, 1892, addressed to M. B. Dodds, Esq., Town Clerk, Stockton-on-Tees.

The Gas Committee do not bind themselves to accept the lowest or any tender.

WM. FORD,
General Manager.

Stockton-on-Tees,
Aug. 1, 1892.

TIPTON GAS-WORKS.

COAL CONTRACTS.

THE Gas Committee of the Tipton Local Board invite TENDERS for the supply of GAS COAL for a period of One, Two, or Three Years from the 1st of September next, in annual quantities of about 10,000 tons, to be delivered, carriage free, to the Gas-Works Siding (L. & N. W. Ry.).

Specification and Form of Tender may be obtained at the Gas-Works, on application to Mr. Vincent Hughes, the Engineer and Manager.

Sealed and endorsed tenders, to be sent to me the undersigned not later than 10 a.m. on Friday, the 26th inst.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
GEO. M. WARING,
Clerk to the Board.

Public Offices, Tipton,
Aug. 8, 1892.

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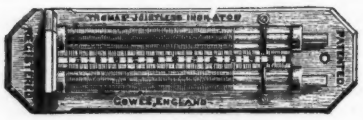

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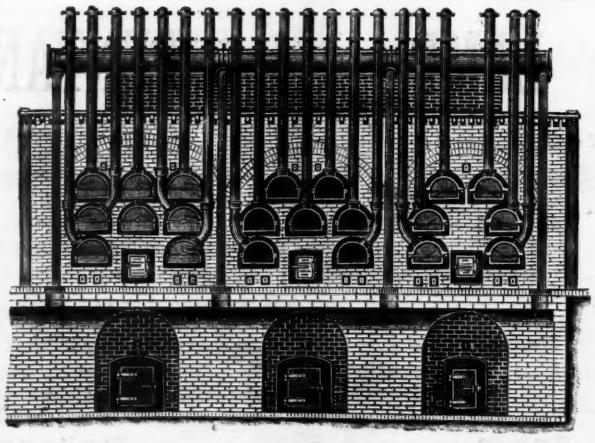

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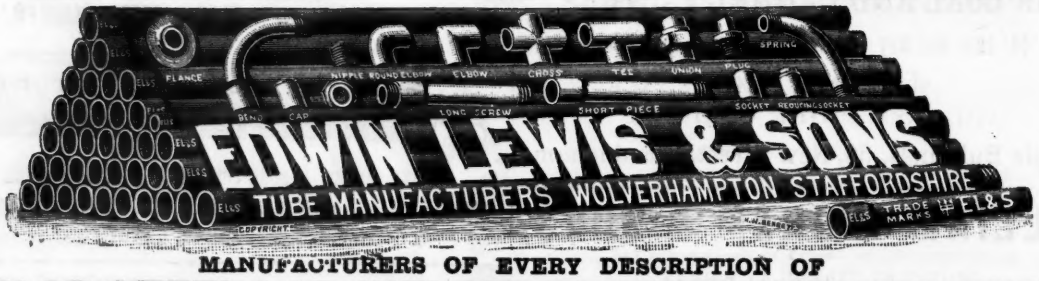

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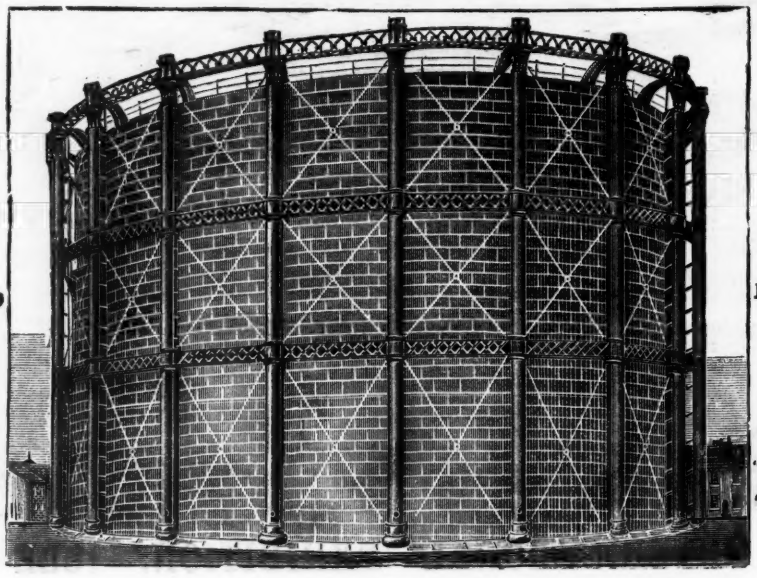

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LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
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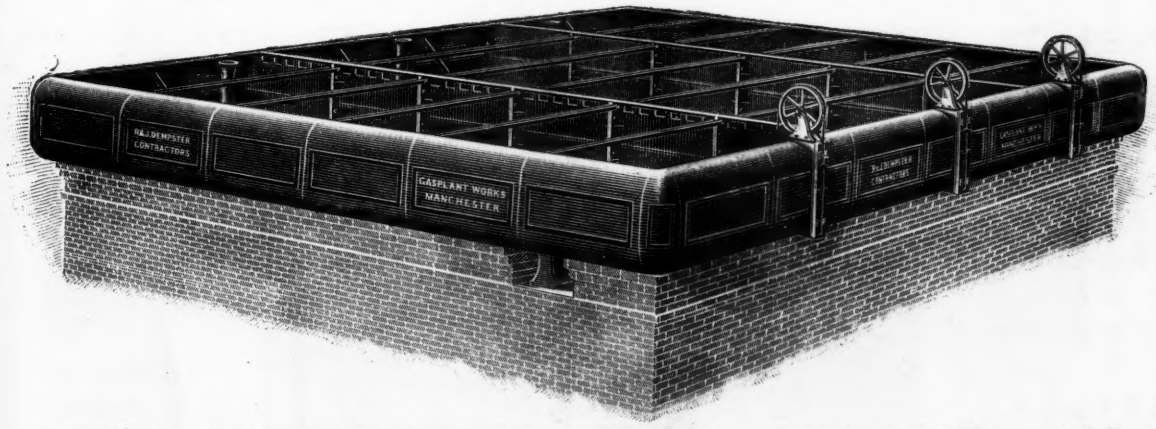

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